SERVICE MANUAL

AKAI TAPE DECK

MODEL X-100D

TABLE OF CONTENTS

I SPECIFICATIONS 1
II MEASURING METHOD 2
III LOCATION OF CONTROLS 4
IV DISASSEMBLY OF TAPE TRANSPORT UNITS & AMPLIFIERS 5
V TRANSPORT MECHANISM 7
VI ADJUSTMENT OF TAPE TRANSPORT UNIT 10
VII ADJUSTMENT OF AMPLIFIER 12
VIII MAINTENANCE PROCEDURES 14
IX LIST OF REPLACEMENT PARTS 15
X EXPLODED VIEW OF COMPONENT PARTS 18
XI TROUBLE SHOOTING CHART 23
XII SCHEMATIC DIAGRAM 27
XIII CONNECTING DIAGRAM 28

I. SPECIFICATIONS

STYLE	: Portable
WEIGHT	: 30 lbs (13.5 kg)
DIMENSIONS	: 13-1/2″ (H)×13-1/2″ (W)×9″ (D) (340 (H)×340 (W)×230 (D) mm) overall, case closed
POWER SUPPLY	: 100, 110, 120, 200, 220, 240 V.A.C.
RECORDING SYSTEM	: Inline 4-track stereo, monaural recording by using Cross-field bias head.
PLAYBACK SYSTEM	: Inline 4-track stereo, monaural playback.
TAPE SPEED	: 3 speeds . . . 1-7/8 ips (4.75 cm/sec.), 3-3/4 ips (9.5 cm/sec.), 7-1/2 ips (19 cm/sec.) and 15 ips (38 cm/sec.) optional.
TAPE SPEED DEVIATION	: Less than ±1.5 % at all tape speeds.
WOW AND FLUTTER (PLAYBACK ONLY)	: Less than 0.15 % R.M.S. at 7-1/2 ips. Less than 0.25 % R.M.S. at 3-3/4 ips. Less than 0.35 % R.M.S. at 1-7/8 ips.
FREQUENCY RESPONSE	: 30 to 23,000 cps (HZ) ±3 db at 7-1/2 ips. 30 to 18,000 cps (HZ) ±3 db at 3-3/4 ips. 30 to 9,000 cps (HZ) ±3 db at 1-7/8 ips.
SIGNAL TO NOISE RATIO	: Better than 45 db.
DISTORTION (TOTAL HARMONICS)	: Within 3 % at 1,000 cps (HZ) 0 VU recording
CROSS-TALK	: Less than −55 db (Monaural) Less than −43 db (Stereo)
INSULATION RESISTANCE	: More than 50 MΩ
INSULATION DURABILITY	: 1,000V. A.C. for more than one minute duration.
ERASE RATIO	: Less than −70 db for all tracks.
POWER CONSUMPTION	: 55 VA
FAST FORWARD AND REWIND TIME	: 90 seconds using 1,200 feet tape at 50 cycles. 75 seconds at 60 cycles.
OUTPUT LEVEL	: 1.228 V (0 VU) at using 1,000 cps 0 VU recorded tape.
OUTPUT IMPEDANCE	: 1.5 KΩ
OUTPUT LEVEL OF HEADPHONE JACK	: 30∼40 mV
OUTPUT IMPEDANCE OF HEADPHONE JACK	: 8 Ω
INPUT LEVEL	
LINE INPUT	: 50 mV∼2.5 V
MIC. INPUT	: 0.5 mV∼20 mV
MONITOR SYSTEM	: Can be monitored the program being recorded by using { Stereo headphone (8 Ω) . . . stereo headphone jack { Crystal receiver . . . . . line output jack
MOTOR	: Hysteresis synchronous 2-speed motor Horse power . . . 1/100 HP Power ratio . . . 85 % Revolution . . . 3,000 to 1,500 R.P.M. at 50 cps (HZ) 3,600 to 1,800 R.P.M. at 60 cps (HZ) Condenser capacity . . . 2.8 uF at 50 cps (HZ) 2.0 uF at 60 cps (HZ)
HEADS	
RECORDING/PLAYBACK HEAD	: Inline 4-tack stereo/monaural. Gap . . . 0.2 microns Impedance . . . 1,000 Ω at 1,000 cps (HZ)
BIAS HEAD	: Inline 4-track stereo. Gap . . . 0.2 mm Impedance . . . 500 Ω at 60 kc.
ERASE HEAD	: Inline 4-track stereo. Gap . . . 0.2 mm Impedance . . . 300 Ω at 60 kc.
RECORD LEVEL INDICATOR	: Vertical indication Model "A" VU meter×2
EQUALIZATION	: Correct equalization for playback of tapes recorded to the NAB curve.
TRANSISTOR USED	: 2SB 443(A)×2 2SB 370A(B)×1 2SB 75(B)×6 2SB 75(F)×2
SILICON DIODE USED	: 5 GB or SW-05-01×2 SD-101×2
REELS USED	: Up to 7″ reel

II. MEASURING METHOD

TAPE SPEED DEVIATION

1. Method involving use of pre-recorded tape.

Playback on the tape recorder to be tested tape pre-recorded at 1,000 cps ±0.1% for measuring tape speed deviation. Connect the appropriate output to a frequency counter meter in order to measure the tape speed deviation from the resulting deviation of the measured frequency.

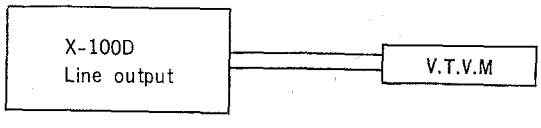
2. Method involving use of timing tape (designed for tape speed measurement).

This method utilizes a timing tape marked at intervals of 7-1/2″. The running time of the tape over 60 marked section is measured in order to calculate the deviation of the tape speed. In application of this method, however, it should be borne in mind that should the timing tape stretch or contract, measurement error is inevitable, so that it is necessary to measure the total length of the tape in advance.

WOW AND FLUTTER

Playback the 3,000 cps pre-recorded tape whose wow and flutter level is guaranteed to be smaller than 0.07% for measurement by means of a wow meter. It is also possible for a 3,000 cps sine wave to be recorded and played for measurement by means of the wow meter. In this case, however, the wow meter indicates a value as much as twice the value given in the specification on the first page.

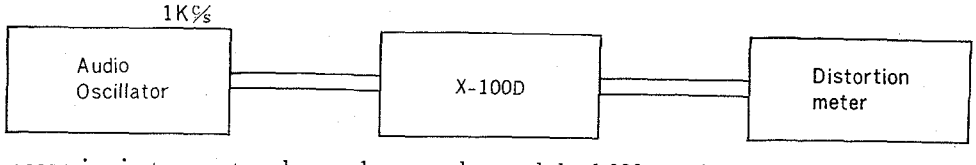
SIGNAL TO NOISE RATIO



Set the Equalizer Switch on "7-1/2 ips" position and playback a tape containing a 1,000 cps sine wave recorded at "0" VU level on a standard recorder. Connect a V.T.V.M. to the line output jack of the recorder and measure its output.

Then remove the tape and measure the noise level under the same condition. Convert into decibels each of the measured values.

TOTAL HARMONIC DISTORTION FACTOR



Connect the measuring instrument as shown above, and record the 1,000 cps sine wave at "0" VU. Playback the resultant signal and measure the overall distortion factor. Measure the noise level of the tape recorder with the tape removed; connect the audio oscillator directly to the distortion meter for measurement of the distortion factor of the oscillator.

The required distortion factor may be obtained from the results of the above measurement by the following formula:

$$d_0 = d - d_1 - d_2$$

where, d_0 = Required

d = Overall distortion factor

d_1 = Noise level

d_2 = Distortion factor of the oscillator

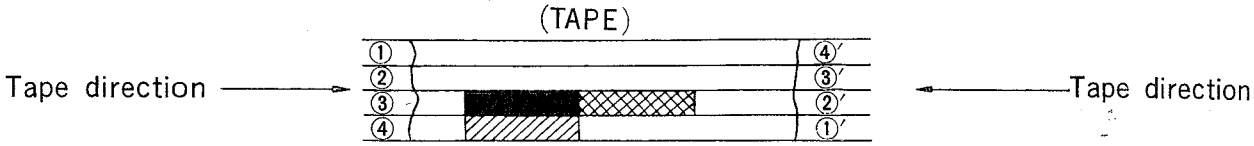
(Note: New tape of particularly good quality should be used for measurement of the distortion factor).

POWER OUTPUT

Playback a tape containing a sine wave of 1,000 cps recorded at 0 VU on a standard recorder.

Connect a V.T.V.M. to the line output jack of the recorder and measure the voltage at the output of the recorder to be tested.

CROSS TALK (Cross talk between the tracks)



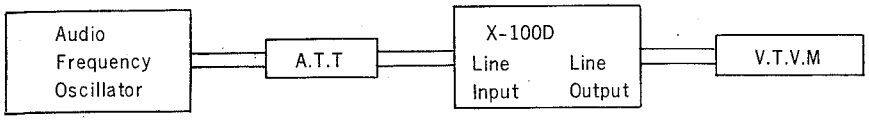
As shown in the figure, first record a 1,000 cps sine wave on track No. 3 at +3 VU level. Next, remove the 1,000 cps input signal and record under a non-input condition.

Then, playback the tape on track No. 3 and No. 1 (reversed condition of tape) through the 1,000 cps B.P.F. (Band Pass Filter, Sensitivity.... 1 : 1) and obtain a ratio between the two from the following formula.

$$C = 20 \log \frac{E_0}{E_2 - E_1} \text{(db)}$$

C = Desired cross talk ratio (db)
E_0 = 1,000 cps signal output level
E_2 = 1,000 cps cross talk output level
E_1 = No-input signal record level

REQUENCY RESPONSE



Connect the measuring instrument as in the above diagram, and measure the frequency response in the following sequence :

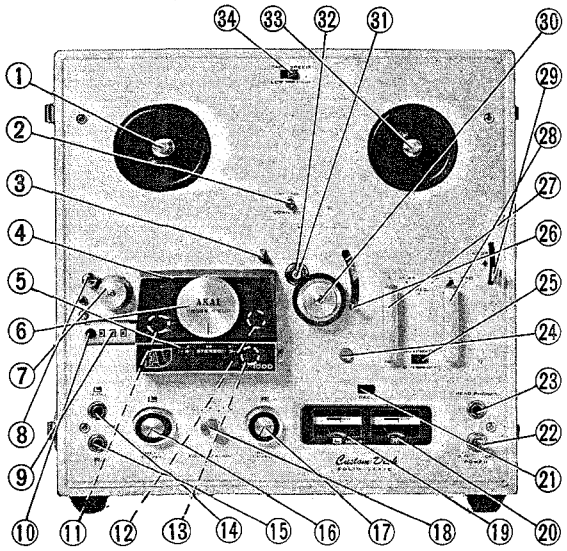
RECORD :

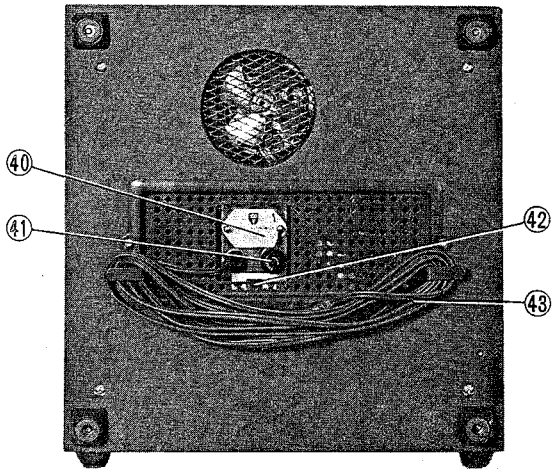
1) Give a sine wave of 1,000 cps to the Line Input of the recorder to be tested through an attenuator from an audio frequency generator.
2) Set the Record/Playback Knob in to "Rec" position and adjust the line input volume so that the VU meter needle indicates "0" VU.
3) Under the condition described in (2), lower the input level 10 db by means of the attenuator.
4) Record the spot frequency in the range of 30 cps to 25,000 cps from the audio frequency generator.

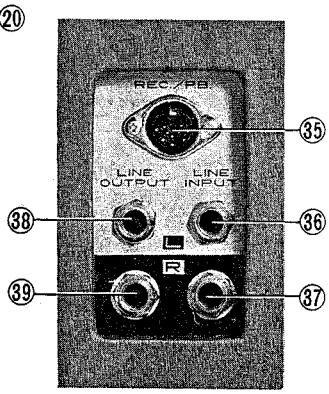
PLAYBACK :

5) Set the Record/Playback Knob in to "Play" position.
6) Set the Equalizer Switch on 7-1/2″ or 3-3/4″ position.
7) Connect a V.T.V.M. to the Line output.
8) Playback the tape previously recorded.
9) Adjust the output level to "0" dbm at 1,000 cps as indicated on the V.T.V.M. by the range selecter of a V.T.V.M.
10) Playback the recorded spot frequencies with the conditions in (9) ; make a memo of output level and plot the value on a graph.

III. LOCATION OF CONTROLS



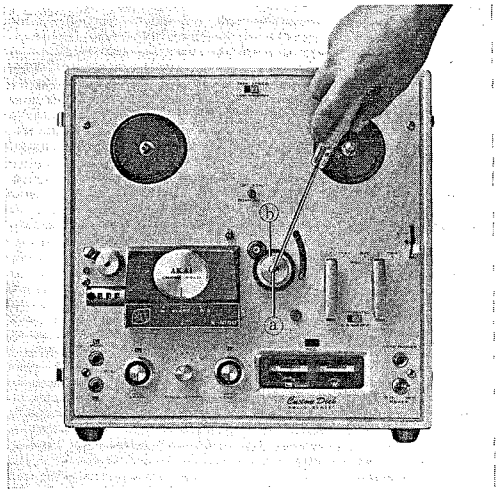




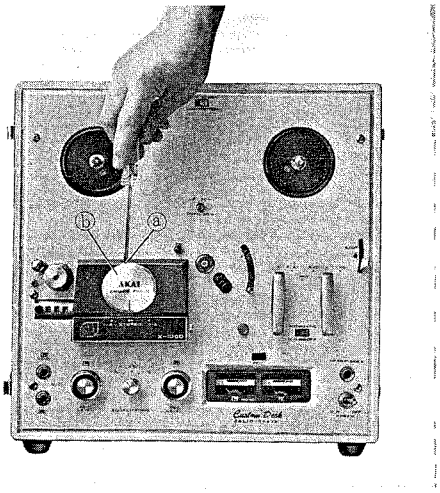
① Supply Reel Shaft
② Cycle Conversion Switch (A)
③ Capstan Storage Post
④ Head Cover (A)
⑤ Head Cover (B)
⑥ Track Selector Knob
⑦ Tape Guide
⑧ Tape Cleaner
⑨ Index Counter
⑩ Reset Button
⑪ Erase Head
⑫ Recording/Playback Head
⑬ Bias Head
⑭ Microphone Jack (Left)
⑮ Microphone Jack (Right)
⑯ Recording Level Control Knob (Left)
⑰ Recording Level Control Knob (Right)
⑱ Equalizer Knob
⑲ VU Meter (Left)
⑳ VU Meter (Right)
㉑ Recording Lamp
㉒ Power Switch
㉓ Stereo Headphone Jack
㉔ Recording Safety Button
㉕ AS Switch
㉖ AS Lever
㉗ Record/Playback Knob
㉘ Fast-Forward/Rewind Knob
㉙ Instant Stop Lever
㉚ Pinch Wheel
㉛ Capstan Shaft
㉜ Capstan
㉝ Take-Up Reel Shaft
㉞ Speed Change Switch
㉟ Din Jack
㊱ Line Input Jack (Left)
㊲ Line Input Jack (Right)
㊳ Line Output Jack (Left)
㊴ Line Output Jack (Right)
㊵ Voltage Conversion Switch
㊶ Fuse Post
㊷ Cycle Convers ion Switch (B)
㊸ AC Cord

IV. DISASSEMBLY OF TAPE TRANSPORT UNITS & AMPLIFIERS

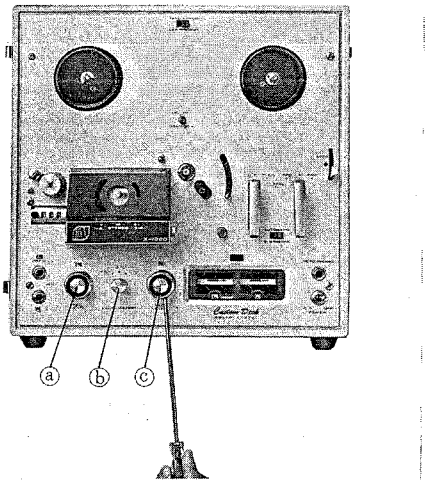
(1) Loosen the RETAINING SCREW (a) of PINCH WHEEL (b) using a phillips-headed screw driver and remove the PINCH WHEEL by hand.



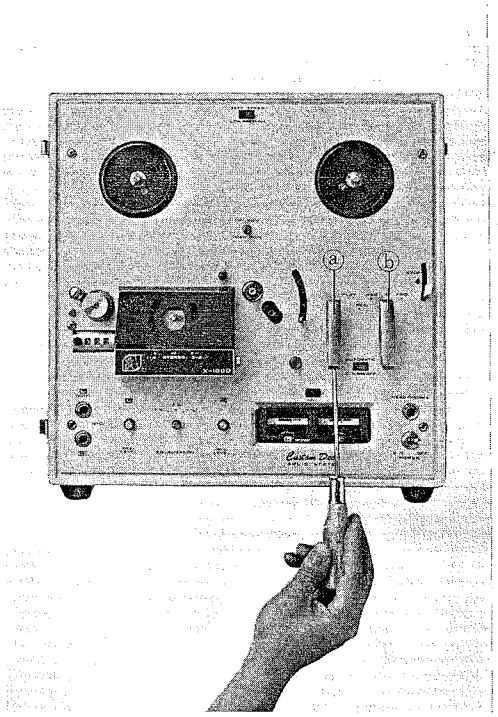
(2) Loosen the RETAINING SCREW (a) of the TRACK SELECTOR KNOB (b) using a phillips-headed screw driver and remove the TRACK SELECTOR KNOB by hand.



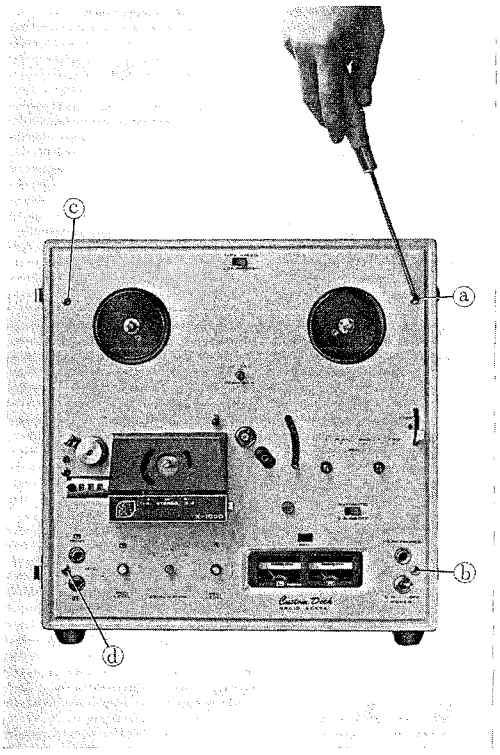
(3) Loosen the RETAINING SCREWS of the KNOBS ((a), (b) and (c)) by using a minus-headed screw driver and remove the KNOBS by hand.



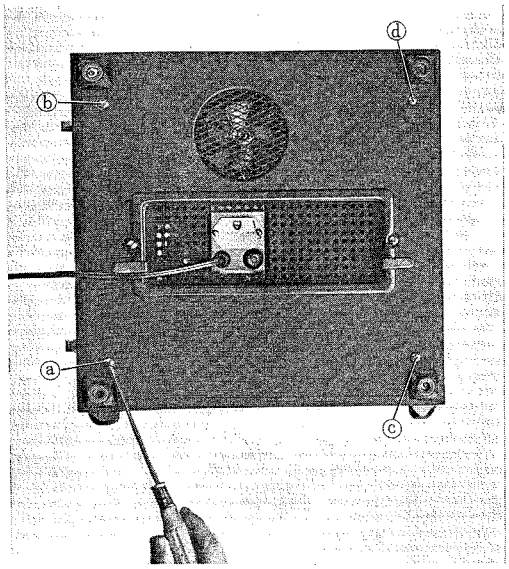
(4) Loosen the RETAINING SCREWS of the DECK CONTROL KNOBS ((a) and (b)) by using a phillips-headed screw driver and remove the KNOBS by hand.



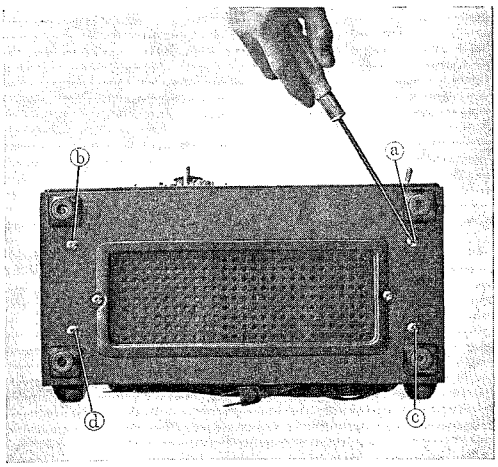
(5) Loosen the SCREWS (marked from (a) to (d)) by using a phillips-headed screw driver and remove the DECK PANEL by hand.



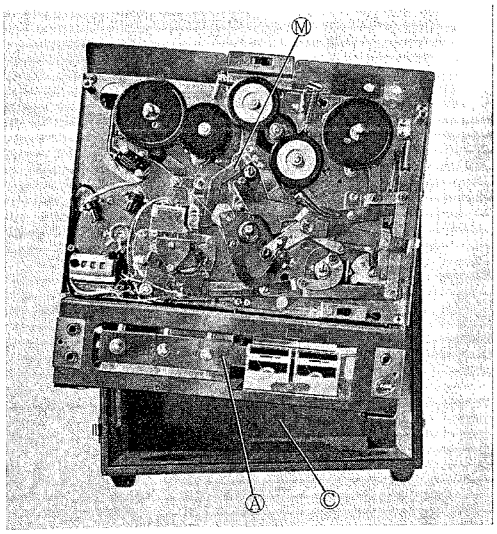
(6) Loosen the SCREWS (marked from (a) to (d)) by using a phillips-headed screw driver.



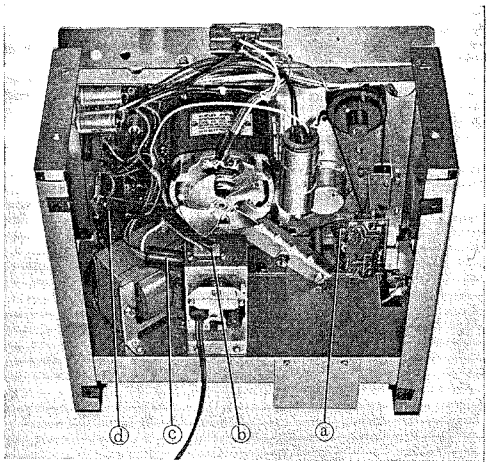
(7) Loosen the SCREWS (marked from (a) to (d)) by using a phillips-headed screw driver.



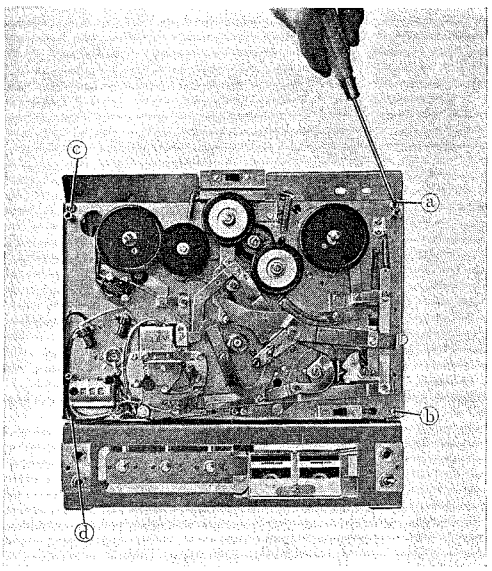
(8) Remove the TAPE TRANSPORT MECHANISM ASSEMBLY (M) and AMPLIFIER ASSEMBLY (A) by slowly lifting it from the CASE (C) as shown in picture.



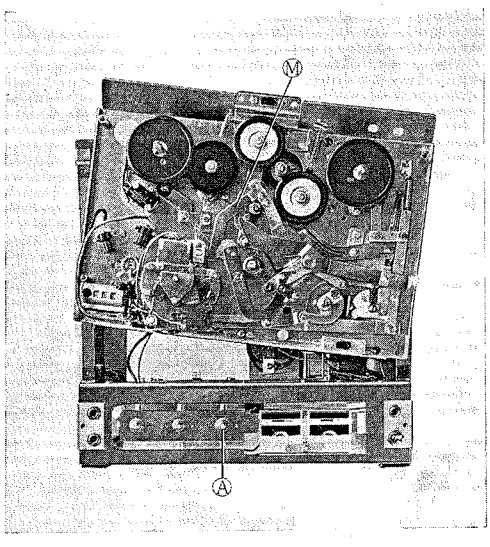
(9) Disconnect the PLUGS (marked (a) to (d)) carefully by hand.



(10) Loosen the SCREWS (marked from (a) to (d)) of the DECK FRAME by using a phillips-headed screw drive



(11) Separate the TAPE TRANSPORT MECHANISM ASSEMBLY (M) from AMPLIFIER ASSEMBLY (A) carefully by hand.



V. TRANSPORT MECHANISM

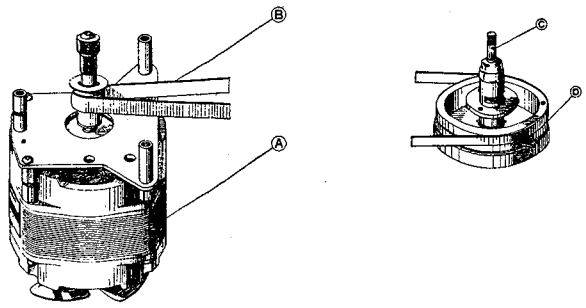


Fig. 1

Driving of Capstan

Figure 1.

(A) Motor
(B) Driving Belt (flat belt)
(C) Capstan
(D) Flywheel

High-speed rotation of *Motor* (A) is reduced by *Driving Belt* (B) and transmitted to Capstan (C), which is connected to flywheel with ample inertia and enables rated rotation by absorbing minor rotation distortion of motor itself.

Capstan Rotation	606 R.P.M. at 7-1/2″ (19 cm) per sec. 303 R.P.M. at 3-3/4″ (9.5 cm) per sec. 151.5 R.P.M. at 1-7/8″ (4.75 cm) per sec.
Motor Rotation	3,000 to 1,500 R.P.M. at 50 cps. 3,600 to 1,800 R.P.M. at 60 cps.

Driving of Pinch Wheel

Put tape between rotating capstan and pinch wheel and push pinch wheel against capstan, this will transport the tape at rated speed. The appropriate pressure of pinch wheel is between 1,000 to 1,150 grams at the tape speed of 7-1/2″ (19 cm) per second.

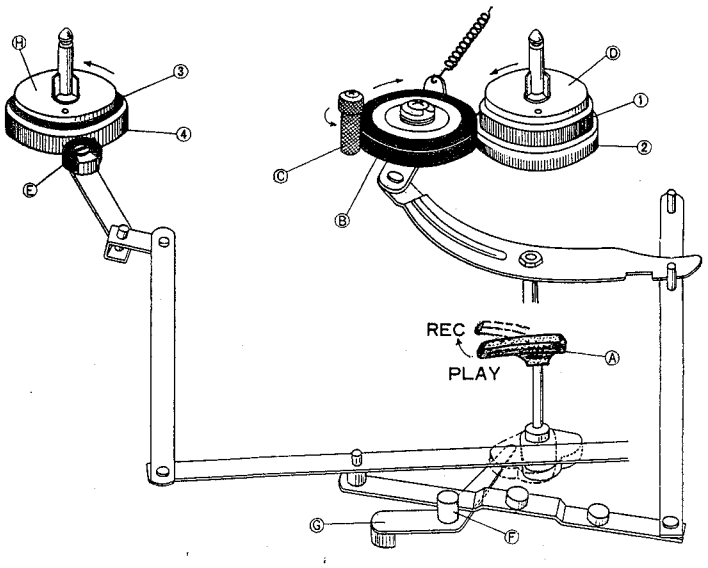


Fig. 2

Recording and Playback

Turn the *RECORD/PLAYBACK KNOB* (A) to "PLAY" position, and pinch wheel presses against capstan to move tape at the rated speed. At the same time, *Idler* (b) moves between *Motor Bushing* (C) and the *Take-Up Reel Spindle* (D) to transmit *the motor rotation* to (D) so that the tape is moved and wound on the take-up reel.

The Take-up Reel Spindle Base is made up of two plastic rollers (1 and 2) with a clutch felt in between. The Idler is rotating *the plastic roller* (2) under. Therefore, the tape-winding friction is adjusted by the slipping of the felt to enable rated winding of the tape.

On the other hand, *the Supply Reel Spindle* (H) has *a Brake Roller* (E) hung on the Plastic Roller (4) under which provides appropriate back tension by the clutch felt slipping to the rotation of the Pulley (3) above.

To prevent accidental erasure, *the Record Interlock Button* (F) must be depressed before the RECORD/PLAYBACK KNOB can be moved to the "REC" position. The *Safety device* (G) is depressed to enter the record mode.

(See figures 2 and 3)

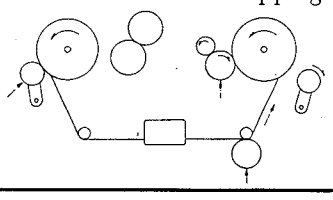


Fig. 3

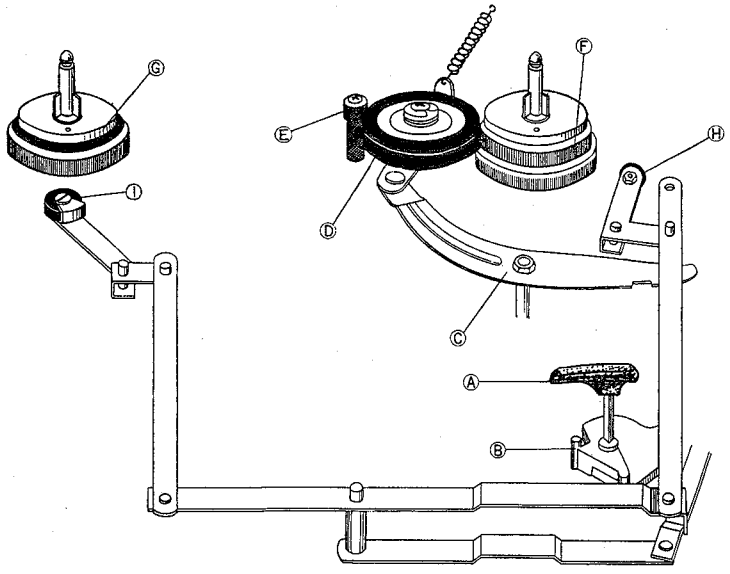


Fig. 4

FAST-FORWARD MECHANISM

Turn *the FAST FWD-REWIND knob* (A) to "FAST FWD" position, and *the cam* (B) under the knob pushes up *the Lever* (C). *The Idler* (D) moves into the space between *the Plastic Roller* (F) above the Take-Up Reel Spindle and the upper part of the rotating motor drive bushing to transmit the motor rotation to the take-up reel spindle. At the same time, *Brake Rollers* (H) and (I) come off the reel spindle to free *the Supply Reel Spindle* (G), thereby allowing fast winding of the tape onto the take-up reel.

(See figures 4 and 5)

Free Rotation High-Speed Rotation

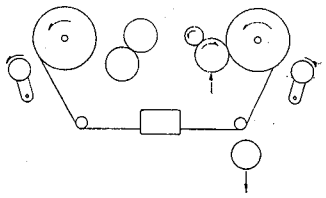


Fig. 5

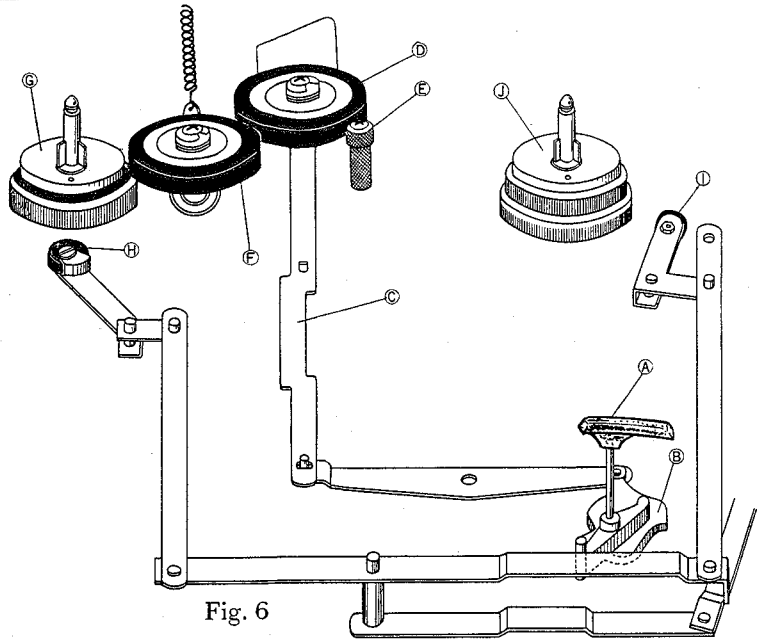


Fig. 6

REWIND MECHANISM

Turn *the FAST FWD-REWIND knob* (A) to "REWIND" position, and *the cam* (B) under the knob pushes *the Lever* (C) up. *The Idler* (D) moves into the space between the upper part of the rotating *Motor drive bushing* (E) and *the Intermediate Pulley* (F) to transmit the high-speed rotation of the motor through the intermediate pulley to *the Supply Reel Spindle* (G). At the same time, *Brake Rollers* (H) and (I) come off the reel spindle to free *the take-up reel spindle* (J), thereby rewinding the tape into the supply reel at a fast speed.

(See figures 6 and 7)

High-Speed Rotation Free Rotation

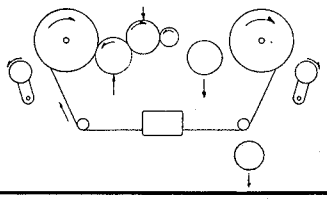


Fig. 7

Modes of Operation	Pinch Wheel	Take-up Idler Wheel	Rewind Idler Wheel	Take-up-side Brake	Supply side Brake
(a) STOP	×	×	×	○	○
(b) FAST-FORWARD	×	○	×	×	×
(c) REWIND	×	×	○	×	○
(d) RECORDING PLAYBACK	○	○	×	×	×

NOTES: ×-marks indicates "open" and
○-marks "engaged"

STOP CONTROL

Push the stop lever to "STOP" position, *Brake Rollers* (A) and (B) depress reel spindles to stop rotation of the reel spindles.

As the brake rubber depresses the plastic rollers under the reel spindles, no friction works on the tape itself.

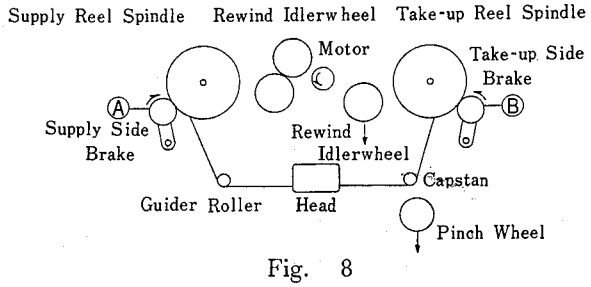


Fig. 8

RECORD/PLAYBACK CHANGING MECHANISM

By turning the RECORD/PLAYBACK KNOB (N) to the recording position, the LEVER (a) pushes the RECORDING LEVER (b) and (c), as illustrated in dotted line, then the RECORD/PLAYBACK CHANGING SWITCH (SW1) turns to recording position.

If the LEVER (b) does not push the LEVER (c) properly, the SW1 does not operate properly so may occur the abnormal oscillation and also can't record.

Then must adjust the LEVER (b) to proper position by loosing the SCREW (d).

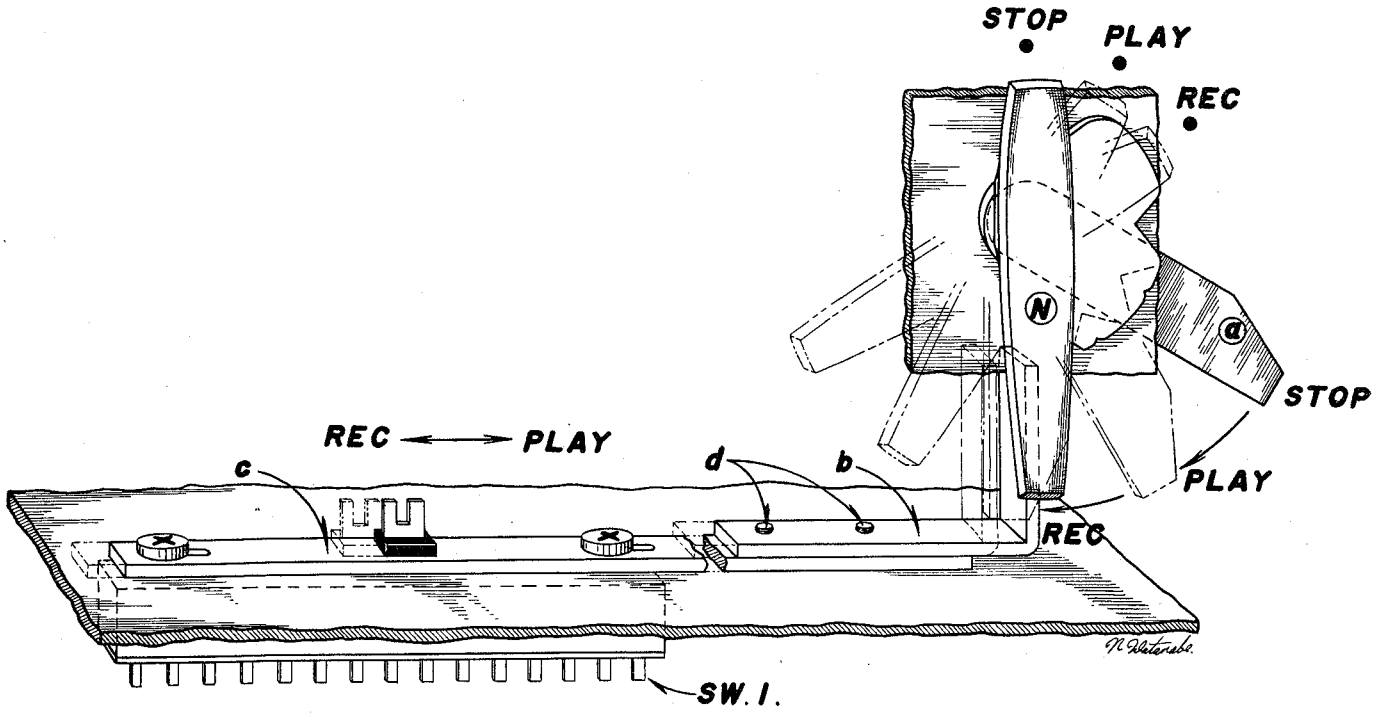


Fig. 9

VI. ADJUSTMENT OF TAPE TRANSPORT UNIT

1. ADJUSTMENT OF PINCH WHEEL

It is important that the pinch wheel shaft is kept in complete alignment with the capstan shaft. A proper pinch wheel pressure is between 1,000 and 1,150 grams when the unit is operated at the tape speed of 7-1/2 ips. Any deviation from this specification will result in wow and flutter. Check pinch wheel pressure by a spring scale and, if necessary, adjust the pinch wheel load spring.

2. ADJUSTMENT OF TAKE-UP IDLER WHEEL

The take-up idler wheel must be kept in complete alignment with the take-up reel shaft. When the unit is set in fast forward condition, the idler wheel will contact to the upper knurled wheel of the take-up reel shaft assembly, and it will contact to the lower knurled wheel during record or play mode. Adjust idler wheel load spring so that the idler wheel pressure is kept between 50 and 80 grams. The idler wheel rapidly wears if the pressure is excessive. The slippage occurs if the pressure is smaller than the specification.

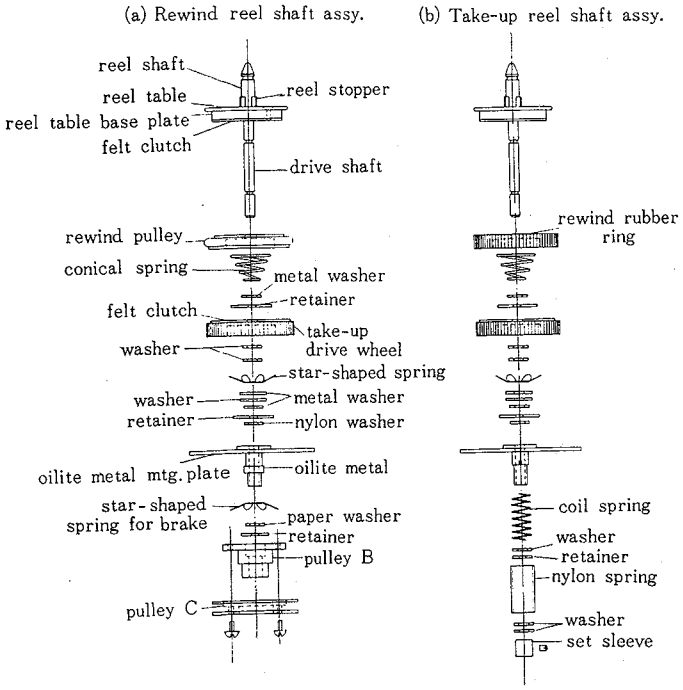


Fig. 1

3. ADJUSTMENT OF REWIND IDLER WHEEL

The rewind idler wheel must be kept in complete alignment with the rewind reel shaft. The amount of pressure to the knurled motor bushing should be maintained about 50 grams during rewind operation. Adjust both the idler load spring and rewind roller.

4. ADJUSTMENT OF INTERMEDIATE WHEEL

The intermediate wheel is located between the rewind idler wheel and the rubber ring which is used on the upper part of the supply reel shaft assembly. When the unit is set in rewind mode, it will contact to these parts simultaneously delivering torque of motor. An adequate pressure is 50 grams. Adjust the load spring of the intermediate wheel if the pressure is not sufficient.

5. ADJUSTMENT OF TAKE-UP REEL SHAFT ASSEMBLY

A felt clutch material is attached to the bottom side of the reel table base plate so that recording tape will not be stretched during fast forwarding operation due to excessive tention. To check the amount of friction of this part, place a 5-inch reel with recording tape wound by 60 m/m in diameter, and gently pull the end of tape upward using a spring scale. Adjust the conical spring so that the amount of tension at this part will be kept between 400 to 500 grams. An other felt clutch material is attached to the take-up drive wheel. It is to provide proper slipping operation during record or play mode. The procedure for checking friction of this part is same as the foregoing, and between 120 and 200 grams of friction will provide the best result. Adjust the star-shaped spring just under the take-up drive wheel. When the unit is set in rewind mode, the amount of friction of this part will greatly be reduced and will become 10 to 20 grams. Check to see whether this is satisfactory if not, readjust the star-shaped spring for Brake, and spring retainer washed accordingly. (See figure 1 (b) at left)

6. ADJUSTMENT OF SUPPLY REEL SHAFT ASSEMBLY

A felt clutch material is used between the lower side of the reel table base plate and the rewind rubber ring to protect recording tape from an excessive tension while rewinding operation. To check the amount of friction of this part, place onto the supply reel table a 5-inch reel with recording tape wound by 60 m/m in diameter and gently pull the end of tape upward by a spring scale. Adjust the conical spring so that the amount of tension is kept between 400 and 500 grams. Another felt clutch is attached to the rewind drive wheel to provide proper slipping operation during record or play mode. The procedure for checking friction of this part is same as the foregoing, and between 80 and 120 grams of friction will give the best result. When the unit is set in fast forward mode, the amount of friction will greatly be reduced and will become 10 to 20 grams.

Check to see whether this is proper, if not, readjust coil spring and spring retainer washer. (See figure 1 (a) at left)

7. ADJUSTMENT OF HEAD

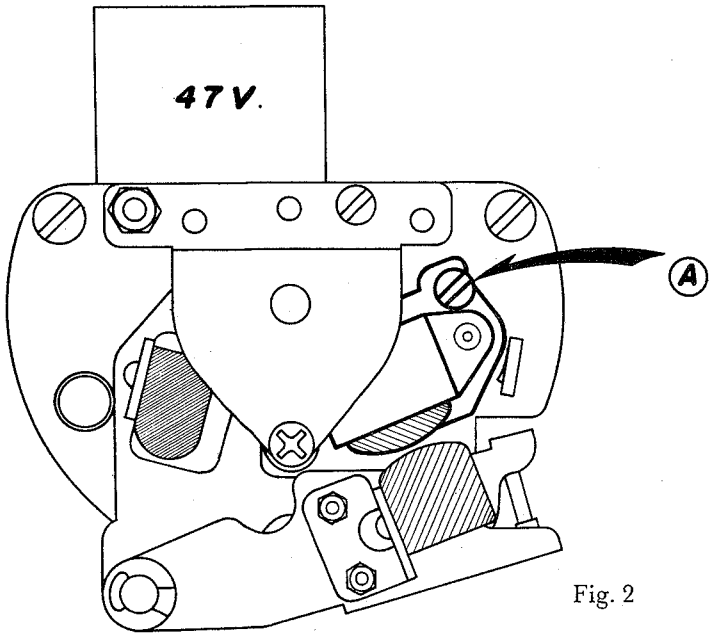


Fig. 2

a) Playback 15 kc/s or 16 kc/s recorded tape and set the azimuth alignment of the Recording/Playback Head by turning the screw (A) until the voltage of the Line Output or the VU meter reads at a maximum.

b) Adjustment of Head Level.

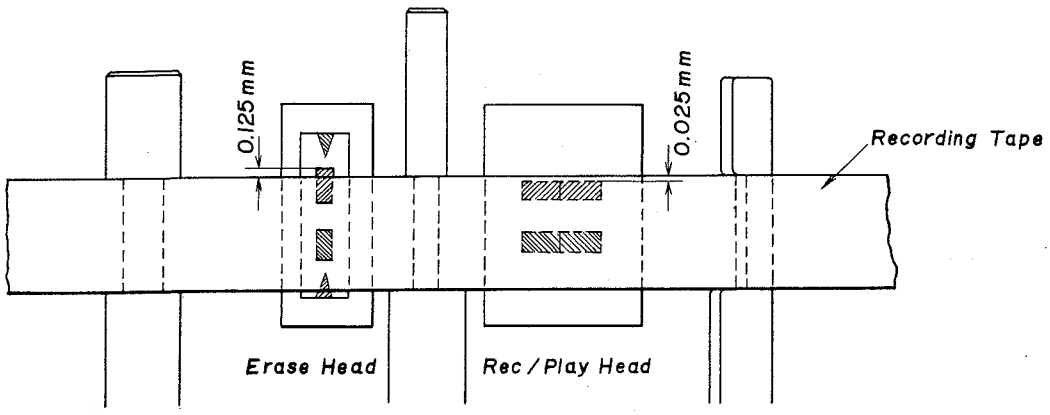


Fig. 3

① Position the Erase Head about 0.125 mm above the upper edge of the tape by adjusting the height of the cam provided in the lower part of the head assembly.

② Adjust the position of the Recording/Playback Head in a manner illustrated in figure 3 by adjusting the level control nut (A) at the lower part of the head assembly.

VII. ADJUSTMENT OF AMPLIFIER

1. ADJUSTMENT OF RECORDING BIAS FREQUENCY

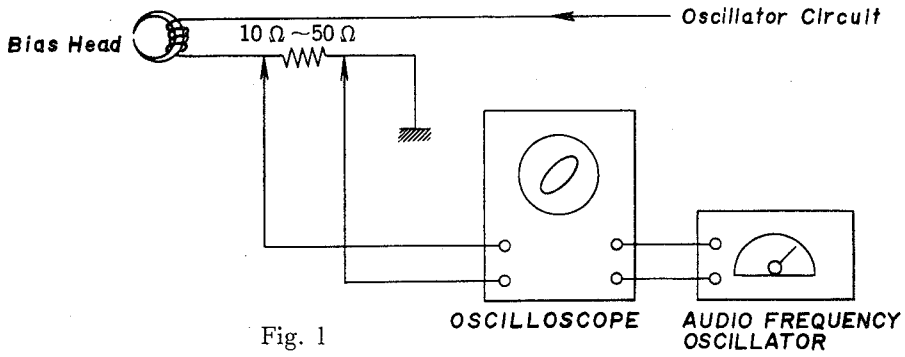


Fig. 1

a) Connect the resistor (10 Ω or 50 Ω) in series with the bias head, and connect the signal from the resistor to the vertical input of the oscilloscope.
The output of the audio frequency oscillator should be connected to the horizontal input of the oscilloscope.
Proper Bias frequency of the recorder X-100D is obtained when the oscilloscope displays a circular or linear waveform with the frequency of the audio frequency oscillator in the neighbourhood of 60 kc/s.
The frequency of the bias oscillator circuit can be adjusted by converting the value of the condenser (C 18. 10,000 PF).

2. ADJUSTMENT OF RECORDING BIAS VOLTAGE

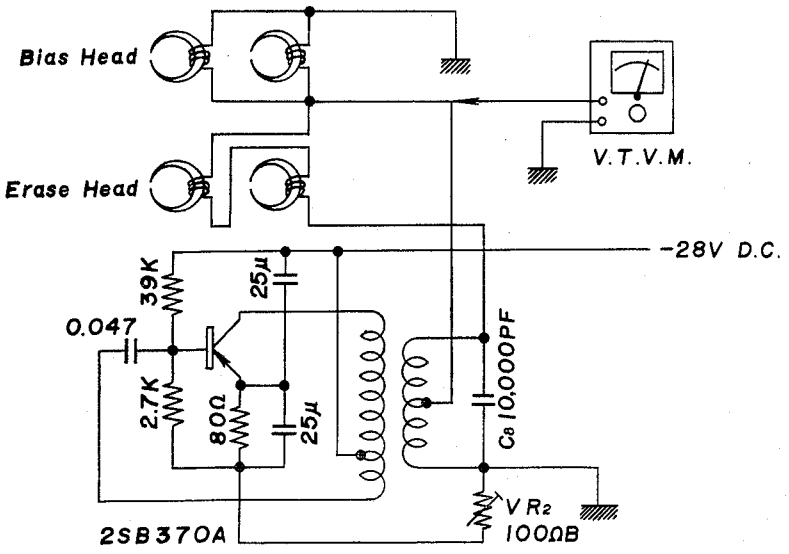


Fig. 2

a) Connect the V.T.V.M to the bias head and fix the recording bias voltage by adjusting the VR2 (100 ΩB) in the bias oscillator circuit (located near the head assembly) until its readings becomes equal to the bias voltage stamped backside the head assembly.
Normal bias voltage is between 42 V and 47 V, while acceptable terminal voltage of the erase head is between 18 V and 24 V.

3. ADJUSTMENT OF PLAYBACK GAIN

a) Playback 0 VU tape recorded with 1,000 c/s signal information and adjust the semi-fixed resister VR201 (20 KΩB) of the preamplifier card so that the pointer of the VU meter registers on 0 VU point (intermediate between red and black).

b) When performing the above adjustments, make sure that the equalization switch has been set in coincidence with the speed of the tape.

4. ADJUSTMENT OF RECORDING LEVEL

a) The recording level should be adjusted after the playback gain has been adjusted in the manner described.

b) Set a standard tape (SCOTCH-111) on the recorder X-100D and put it in a recording mode of operation.

c) Connect the signal of 1,000 c/s from the audio oscillator to the line input of the recorder X-100D, and adjust the volume control so that the pointer of the VU meter registers on 0 VU (intermediate between red and black).

d) Now record the tape and check on playback whether the pointer of the VU meter comes on the 0 VU point.

e) If the pointer of the VU meter fails to register with 0 VU, repeat the recording and playback by adjusting the semi-fixed register VR101 (2 KΩB) of the recording preamplifier until the 0 VU reading is obtained both on recording and playback.

VIII. MAINTENANCE PROCEDURES

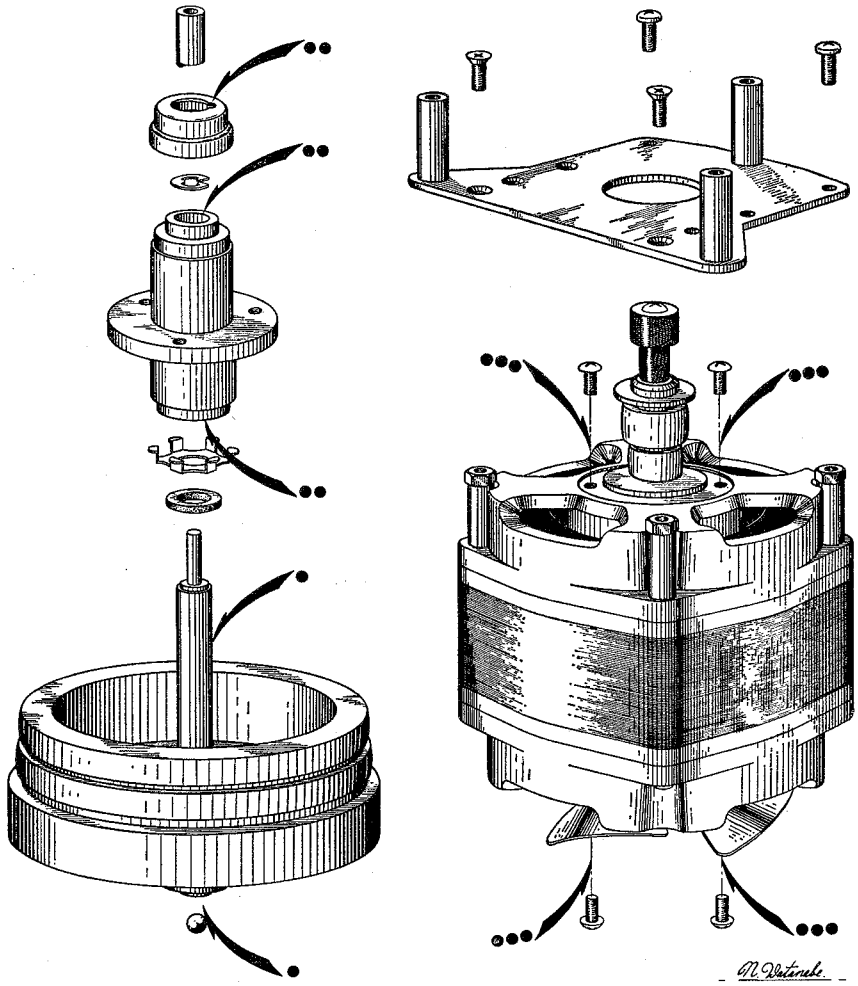
1. LUBRICATION INSTRUCTION

For maximum service life and optimum performance, lubricate the parts identified below after each 500 hours of operation. Use only light machine oil of good quality.

Motor	
Flywheel Assembly	
Rewind Idler Wheel and Wind Take-Up Idler.	1 drop
Intermediate Idler	1 drop
Pinch Wheel	1 drop

Also apply a liberal film of light machine grease to each roller surface of all levers and cams.

CAUTION: DO NOT OVER-LUBRICATE, AND WIPE OFF EXCESS OIL BY A COTTON SWAB SOAKED IN ALCOHOL. OTHERWISE, THE OVER-FLOWED LUBRICANT MAY BE SCATTERED DURING OPERATION. THE RUBBER COMPONENT PARTS WILL BE DETERIORATED.



FLYWHEEL ● 1 drop MOTOR

Fig. 1

2. CLEANING TAPE HEADS AND OTHER PARTS

Wipe surface of tape heads, guide roller bearing, capstan bushing and pinch wheel periodically with a soft cloth soaked in alcohol or carbon-tet.

IX. LIST OF REPLACEMENT PARTS

Parts No.	Nomenclature
C1-001	Deck Panel
002	Knob, Track Selector Control
002a	Screw, Retaining Track Selector Control Knob
003	Head Cover (Main)
004	Head Cover (Sub)
005	Base, Head Cover
006a	Capstan Rest
006b	Capstan Holder
007a	Top Plate, Tape Guide
007b	Table, Tape Guide
007c	Bearing, Tape Guide
007d	Bottom Plate, Tape Guide
008	Tape Cleaner, Complete
008a	Felt, Tape Cleaner
009	Prop A, Head Cover
010	Prop C, Head Cover
011	Escutcheon, Meter
012	Escutcheon, Recording Lamp

DECK FRAME

C2-001	Deck Frame
002	Head Assembly, Complete
002a	Erase Head
002b	Record/Playback Head
002c	Bias Head
002d	μ Spring, D
002e	Tape Guide (No.17)
002f	Tape Guide (N-3)
002g	Tape Guide (N-2)
002h	Table, Head
002i	4 T Cam
002j	Gear B, Head
002k	Spring, Field Table
002l	Holder, Spring
002m	Nut, Head Lever
002n	Up-Down Table, Field
002o	Table, Field
002p	Spring, Field Table
002q	Micro Angle Table
002r	4 T Shaft
002s	Upper Plate, Head
002t	Screw, Angle Adjustment
002u	Plate, retaining Erase Head
002v	Plate, retaining Record/Playback Head
002w	Side Plate, Bias Head
002x	Rotary Switch
002y	Gear A, Head
002z	4 T Switch Table

Parts No.	Nomenclature
C2-003	Tape Counter, Complete
003a	Pulley, Counter
003b	Belt, Counter
004	Supply Reel Assembly, Complete
004a	Plate (Large), Reel
004b	Shaft A, Reel
004c	Rubber Ring
004d	Rewind Pulley
004e	Spring G (Left)
004f	Washer
004g	Thrust Washer Pin, Reel
004h	Take-up Roller, C
004i	Holder, Reel (Star Type Spring)
004j	Nylon Washer
004k	Washer
004l	Washer
004m	Thrust Washer Pin, Reel
004n	Washer
004o	Washer
004p	Metal Fitting, Reel
004q	Holder, Reel (Star Type Spring)
004r	Washer
004s	Washer Pin
004t	Pulley B2, Reel
004u	Screw, without Head 4×7
004v	Pulley C, Reel
004w	Screw Flat 3×6
004x	Screw
005	Take-up Reel Assembly, Complete
005a	Take-up Roller, A
005b	Spring G (Right)
005c	Take-up Roller, D
005d	Spring F3
005e	Washer
005f	Washer
005g	Set Sleeve
005h	Screw, without Head 3×3.2
005i	Nylon Tube
006a	AS Lever, Complete
006b	Spring, AS Lever
006c	Plate, AS Lever (with Prop)
007a	Instant Stop Lever, A
007b	Spring, Instant Stop Lever
007c	Stopper, Instant Stop Lever
007d	Holder B, Instant Stop Lever
007e	Screw, Retaining Instant Stop Lever
008a	Recording Safety Button
008b	Cam Stopper
008c	Fiber, Cam Stopper
008d	Insulator Plate, Cam Stopper
009a	Pinch Wheel
009b	Metal Cap, Pinch Wheel
009c	Screw, Pinch Wheel
009d	Lever, Pinch Wheel
009e	Shaft C, Pinch Wheel
009f	Spring, Pinch Wheel

Parts No.	Nomenclature
C2-009g	Shaft A, Cam Roller
009h	Cam Roller, B
010a	Lever, Take-up Brake Roller
010b	Rubber (Small), Brake
010c	Screw, Brake Roller
010d	Shaft, Brake Lever
011a	Lever, Supply Brake Roller
011b	Rubber (Large), Brake
011c	Screw, Brake Roller
011d	Shaft, Brake Lever
012a	6 P Slide Switch ESS-22C-NB (Automatic Switch)
012b	Plate, Automatic Switch
013a	Speed Change Switch
013b	Table, Speed Change Switch
014	Idler Wheel, A
015	Internal Wheel
016a	Lever, A (with Lever E)
016b	Shaft, Lever A
016c	Spring, D
017a	Lever, B (with Lever D)
017b	Cam Roller, A
017c	Cam Roller, B
017d	Spring, B
018a	Lever, C3
018b	Spring, D
019a	Lever, G (with Lever H-D)
019b	Metal, Lever G
019c	Shaft B, Idler
019d	Spring, Lever H-D
020a	Lever, K
020b	Screw
020c	Torsion Spring, D
020d	Bush
021a	Lever, FA
021b	Cam Roller, A
022	Lever, F (for Motor)
023	Lever, A2
024	Field Lever, A
025	Field Lever, B
026	Field Lever, D
027	Field Lever, E
028	Prop A, Panel

Parts No.	Nomenclature
C2-029	Holder B, Spring
030	Pin B, Spring
031	Stopper C, Lever G
032	Hum Bucking Coil
033	Cycle Change Switch
034	Micro Switch V-1A
035	3 P Lug Plate
036	4 P Jack
037	Variable Resistor 100 ohms B-W 183K
038a	Lever, Belt Change
038b	Stopper, Belt Change Lever
038c	Spring, Belt Change Lever
038d	Spring B, Belt Change Lever
040	Table, Oscillator Card Block
041	Supporting Angle

MOTOR BLOCK

C3-001	Motor, Complete
001a	+ Screw Semi-Cubic 3×15
001b	Stepped Pulley
001c	Motor Pulley
001d	Holder L, Motor
001f	Motor Fan
001g	Screw, without Head
001h	Prop A, Motor
001i	Prop B, Motor
001j	MP Condenser 2μ+0.8μ 300 VAC
001k	Holder, MP Condenser
001l	+ Screw Flat Mould 4×50
001m	External Shield Plate, Motor
002a	MP Condenser 1μ 300 VAC
002b	5P Lug Plate
003	Drive Belt

FLYWHEEL

C4-001	Flywheel, Complete
001a	Capstan
001b	Main Metal Cap, B
001c	Washer Pin
001d	Main Metal Case, B
001e	Spring, Main Metal
001f	Nylon Washer
001g	Main Shaft C
001i	4 mm Ball Bearing
001j	Nylon Plate
001k	Plate B, Flywheel
001l	Washer
001m	Spring Washer
001n	Washer

Parts No.	Nomenclature
C4-001o	5 mm Wing Nut
001p	Screw, Flywheel Adjustment
001q	5 mm Nut
001r	Prop B, Flywheel
001s	Prop A, Flywheel

SWITCH BLOCK

C5-001	Switch Block, Complete
001a	Knob, Record/Play & Rewind Forward Fast
001b	Screw
001c	Cam, A-2
001d	Cam, B
001e	Cam Roller, A
001f	Switch Table, A
001g	Spring, E
001h	Lever, I
001i	Screw
001j	4 mm Nut
001k	Rotary Switch S-133-B
001l	Fast/Forward Rewind Shaft
001m	Plate, Cam
001n	Spring, K
001o	Cam, C
001p	+ Screw Flat Mould 4×6
001q	Shield, Mechanism Switch
001r	Switch Table, B
001s	Washer
001t	Cam
001u	Washer
001v	Washer Pin
002a	Wired Resistor 5 W 170 ohms
002b	5P Lug Plate

CASE BLOCK

C6-001	Case
002a	Table, Rubber Foot
002b	Rubber Foot
002c	+ Semi-Cubic 3×6
003	Ventilator (Panel Escutcheon)
004	Ventilator
005a	Speaker Chassis, A
005b	Speaker Chassis, B
006	Speed Nut

AMPLIFIER

C7-001	Amp. Chassis
001a	Lug Plate, 2L2
001b	Lug Plate, 1L1
001c	Lug Plate, 1L
002	Power Transformer (T-1)
002a	Angle, Transformer
003a	Holder, Jack
003b	Name Plate, Jack

Parts No.	Nomenclature
C7-004a	DIN Jack (J11)
004b	2 Pole E1 Jack (J7·9)
004c	2 Pole E Jack (J6·8)
004d	2 Pole E1 Jack (J5) (Mic.)
004e	3 Pole E Jack (J) (Headphone)
005	Toggle Switch ST-110A (Power Switch)
006a	Plate D, Jack
006b	Plate C, Jack
007	Variable Resistor 10K ohms (A) (VR1)
008	Rotary Switch F-243
008a	Shield Holder
009a	Amplifier Lever, A
009b	Amplifier Lever, B
009c	Spring B
010a	Lamp Socket (Swan Type)
010b	Pilot Lamp
011	VU Meter
012a	Holder D, Multi Jack
012b	10P Multi Jack
012c	Prop, Multi Jack
013a	Resistor 1/4P 680 ohms K
013b	Resistor 1/4P 100K ohms
013c	Resistor 1/4P 15K ohms
013d	Wired Resistor 2W 80 ohms
013e	Resistor 1W 1.2K ohms
013f	Resistor 2.2K ohms
014a	Polyester Condenser 35WV 680PF
014b	Tubular Type Electrolytic Condenser 500μF 25WV
014c	Tubular Type Electrolytic Condenser 200μF 25WV
014d	Tubular Type Electrolytic Condenser 500μF 50WV
015	Holder, Card
016	Shield
017	Silicon Diode 5 GB
018	Angle, Voltage Change
019	6P Slide Switch ESS-22A-NB
020	Name Plate, Cycle Change
021	Socket, Voltage Change
022	Hexangular Prop, Selector
023	Plug S, Voltage Change

Parts No.	Nomenclature
C7-024	Name Plate, AC Change
-025	Closed Nut
026	2P Jack (J3)
027a	Fuse Post
027b	Fuse, 1A
028	Cord Support
029	Rubber Bush, AC Cord
030	AC Cord (10 Feet)
031	Chip Jack (Red)
032	4P Connector Socket
033	Knob A (Rec. Level)
034	Knob B (Equalizer)
035	4P Plug

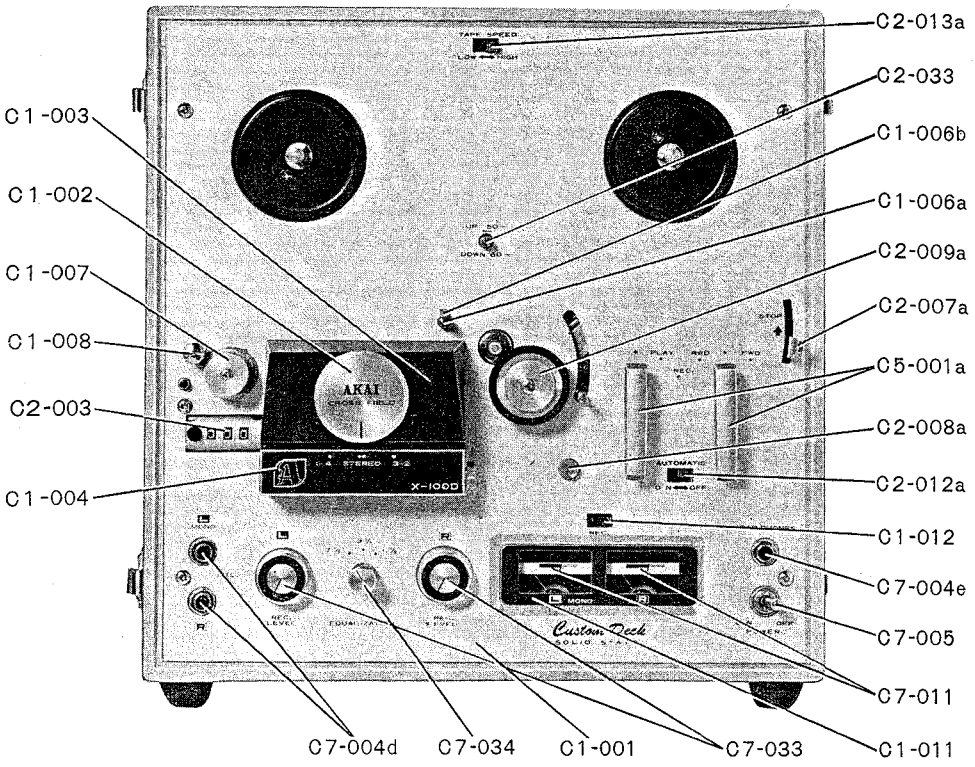
CARD BLOCK

C8-001	Switch Block Card, Complete (CD 501)
002	Printed Plate, Switch Block
003	Slide Switch SL-1021
004	Transistor 2SB 171 (B)
005a	Resistor RD 1/8P 330 ohms K
005b	Resistor RD 1/8P 56K ohms K
005c	Resistor RD 1/8P 22K ohms K
005d	Resistor RD 1/8P 5.6K ohms K
005e	Resistor RD 1/8P 6.8K ohms K
005f	Resistor RD 1/8P 1K ohms K
005g	Resistor RD 1/8P 15K ohms K
005h	Resistor RD 1/8P 820 ohms K
005i	Resistor RD 1/8P 35K ohms K
005j	Resistor RD 1/8P 3K ohms J
006a	Polyester Film Condenser 220P 350WV (K)
006b	Condenser MEL 0.033P 50V (K)
006c	Condenser 0.01P 50V (K)
006d	Condenser 0.047P 50V (K)
006e	Condenser 0.1P 50V (K)
006f	Condenser 3μ 25V
006g	Condenser 100μ 3V
006h	Condenser 10μ 10V
007	Variable Resistor 2KB. V10K
008	Peaking Coil 300μH
009	Diode IN34A
010	4P Plug

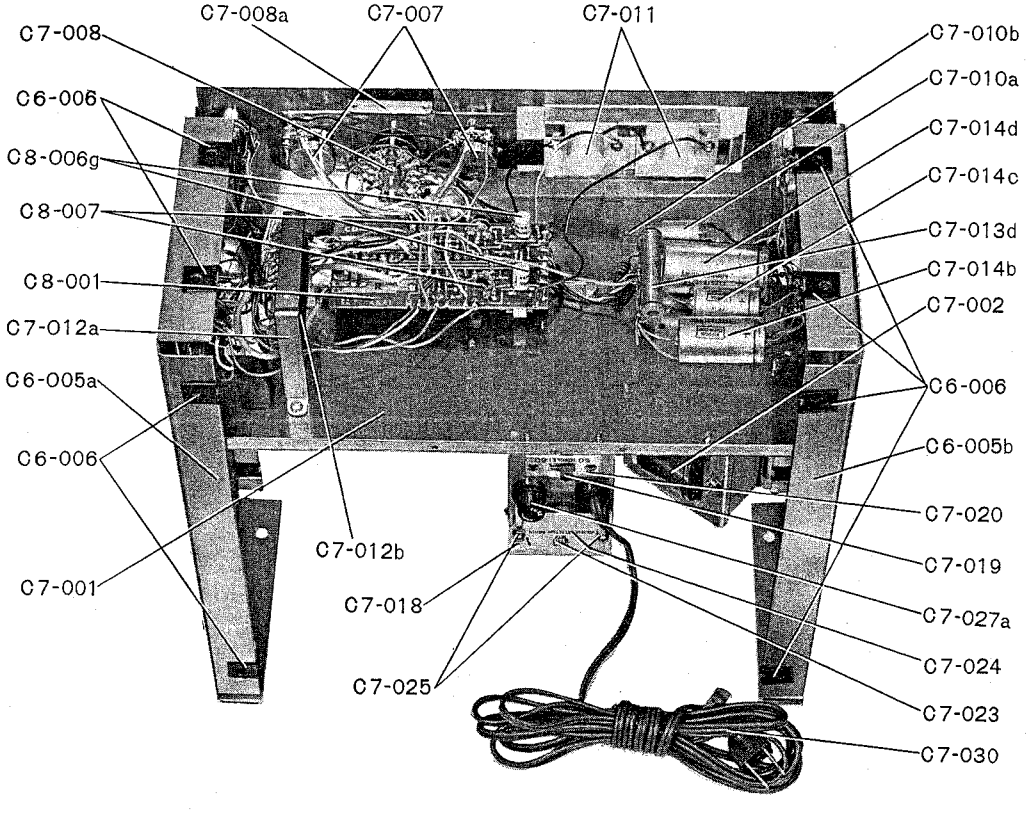
Parts No.	Nomenclature
C9-001	CD-502 Card, Complete
002	Printed Plate, CD-502 Card
003a	Transistor 2SB 347
003b	Transistor 2SB 173 (B)
003c	Transistor 2SB 171 (B)
004a	Resistor RD 1/4P 100K ohms K
004b	Resistor RD 1/4P 10K ohms K
004c	Resistor RD 1/4P 3K ohms K
004d	Resistor RD 1/4P 300 ohms K
004e	Resistor RD 1/4P 6.8K ohms K
004f	Resistor RD 1/4P 3.3K ohms K
004g	Resistor RD 1/4P 2.2K ohms K
004h	Resistor RD 1/4P 15K ohms K
004i	Resistor RD 1/4P 560 ohms K
004j	Resistor RD 1/4P 100 ohms K
004k	Resistor RD 1/4P 1.5K ohms K
004l	Resistor RD 1/4P 560 ohms K
004m	Resistor RD 1/4P 220 ohms K
004n	Resistor RD 1/4P 1.8K ohms K
005	Variable Resistor V10K 5-Type B-20K
006a	Condenser 30μ 3V
006b	Condenser 100μ 3V
006c	Condenser 100μ 10V
006d	Condenser 10μ 10V
006e	Condenser 100μ 3V
006f	Condenser 10μ 25V
006g	Condenser 50μ 25V
006h	Condenser 100μ 6V
007	Headphone Transformer 7K : 8 ohms
C10-001	CD-503 Card, Complete
002	Printed Plate, 503 Card
003	Oscillator Coil
004	Transistor 2SB 370A (B)
005a	Resistor RD 1/8P 2.7K ohms K
005b	Resistor RD 1/8P 3.9K ohms K
005c	Resistor 2L 80 ohms K
006a	Condenser CEMX 25μ or 30μ 25V
006b	Plastic Condenser 10,000P 500V V
006c	Polyester Film Condenser 0.047 (K) 50V
007	Radiative Table
008	Radiative Plate

X. EXPLODED VIEW OF COMPONENT PARTS

FRONT PANEL



AMPLIFIER



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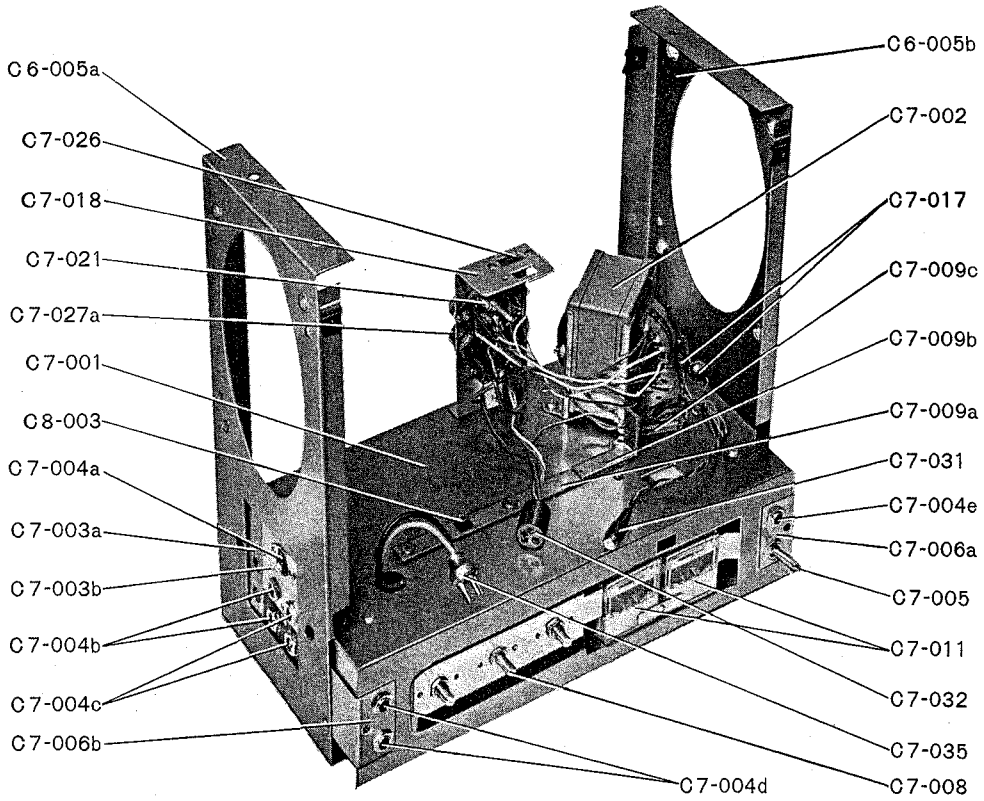
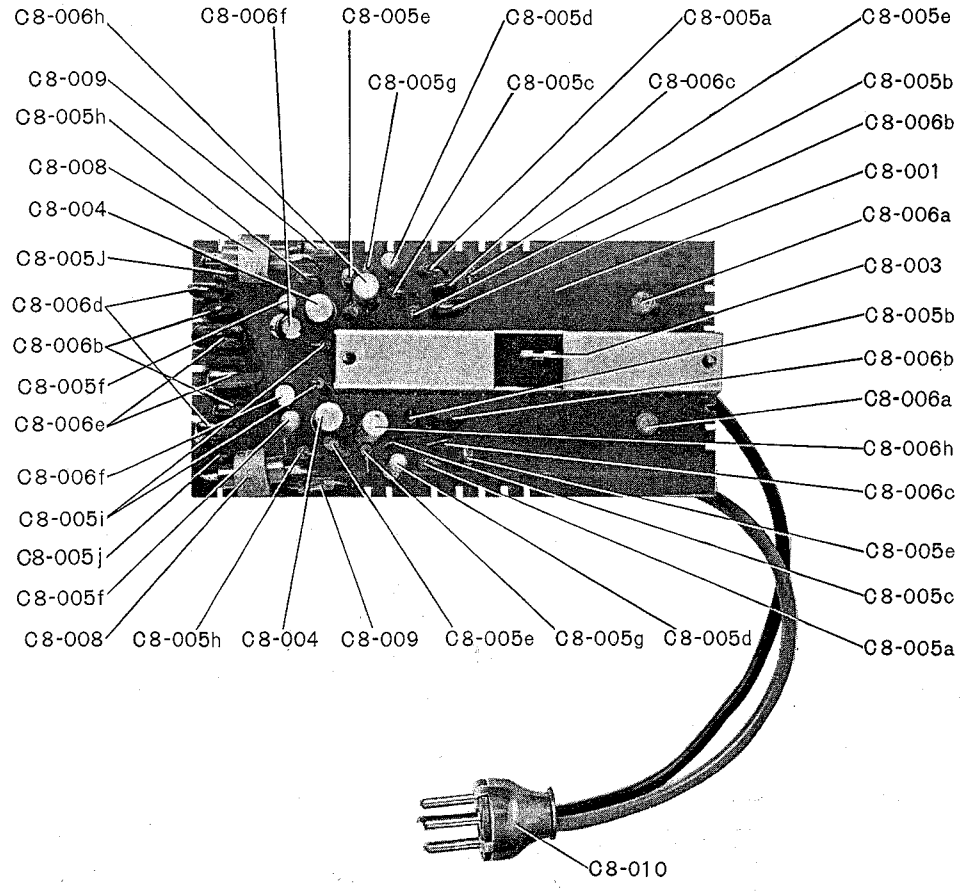
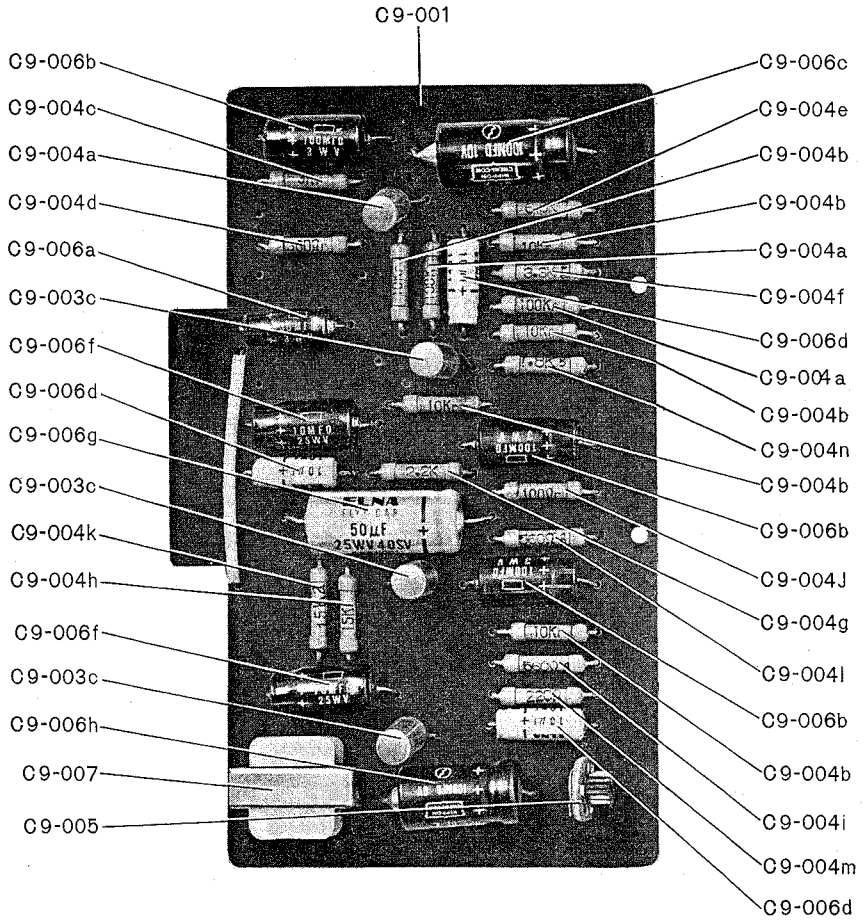


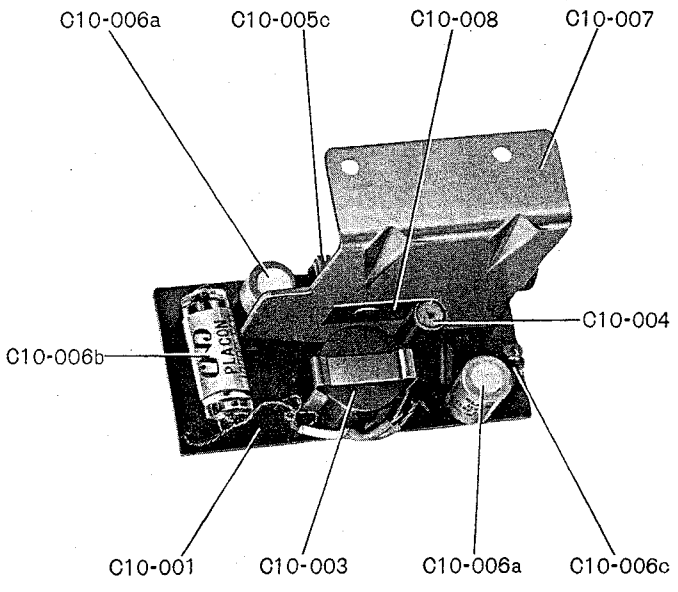
CD-501 Card Block



CD-502 Card Block



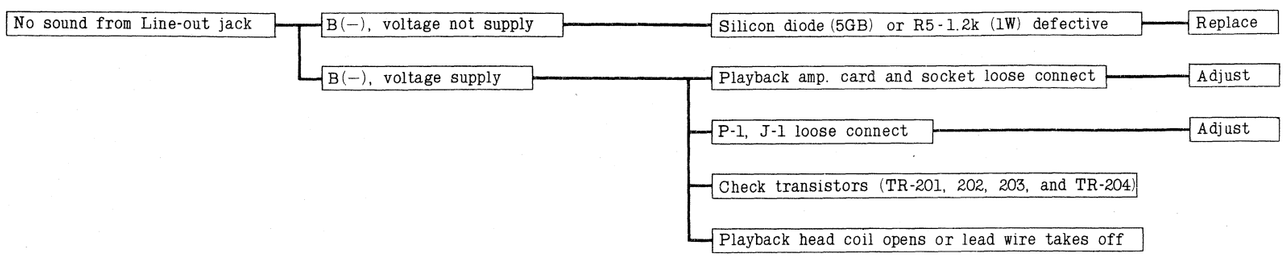
CD-503 Card Block

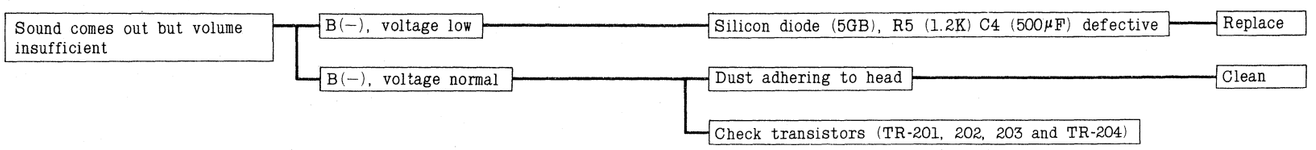


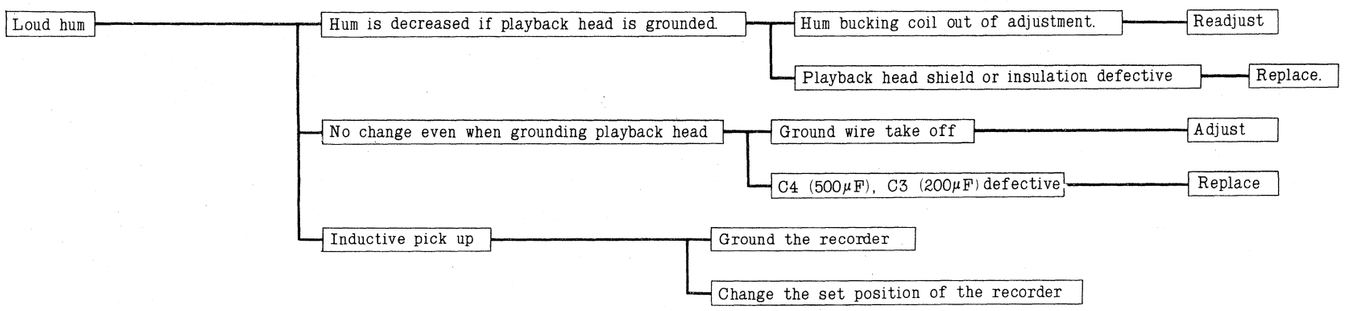
XI. TROUBLE SHOOTING CHART

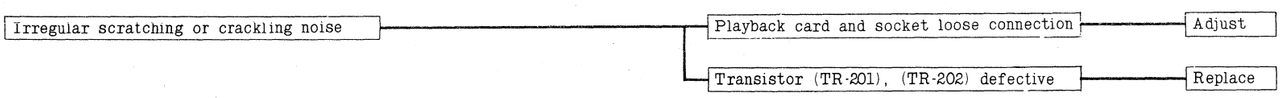
SECTION "A" TROUBLES WITH AMPLIFIER

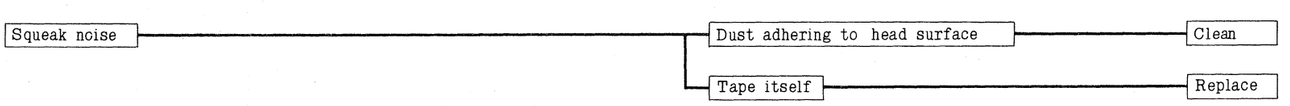
1. Playback problems. (Unit set in play position.)

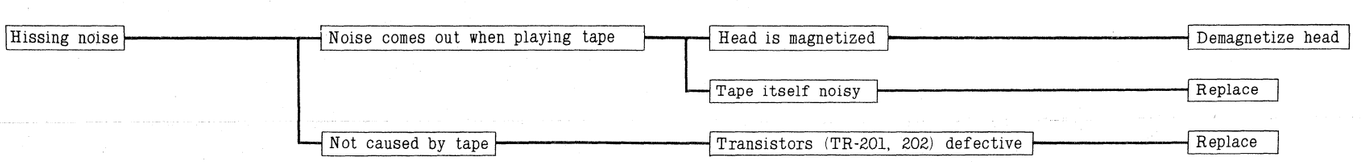

No sound from Line-out jack
B(−), voltage not supply
Silicon diode (5GB) or R5 - 1.2k (1W) defective
Replace
B(−), voltage supply
Playback amp. card and socket loose connect
Adjust
P-1, J-1 loose connect
Adjust
Check transistors (TR-201, 202, 203, and TR-204)
Playback head coil opens or lead wire takes off

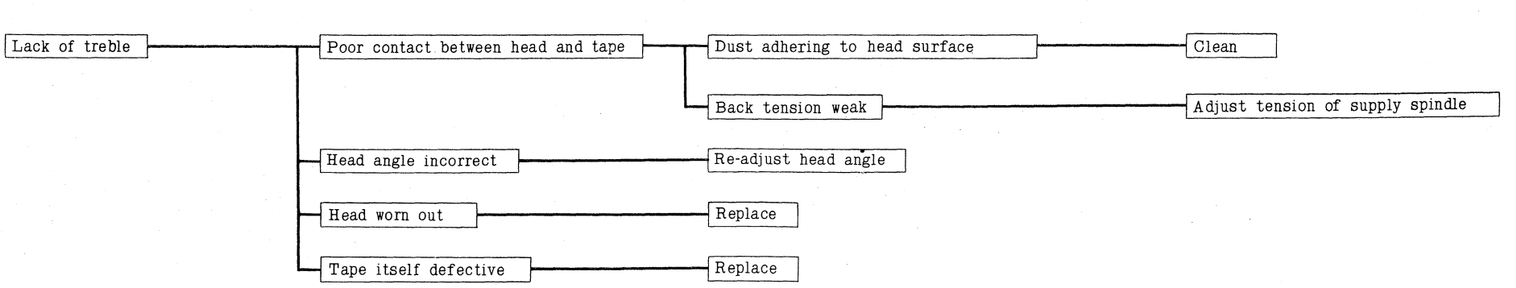

Sound comes out but volume insufficient
B(−), voltage low
Silicon diode (5GB), R5 (1.2K) C4 (500μF) defective
Replace
B(−), voltage normal
Dust adhering to head
Clean
Check transistors (TR-201, 202, 203 and TR-204)

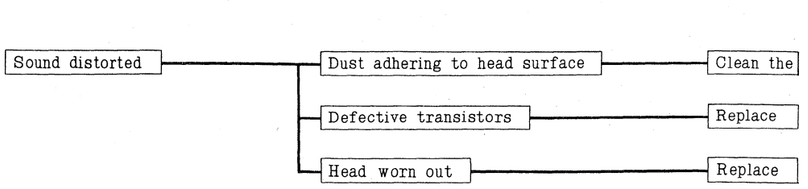






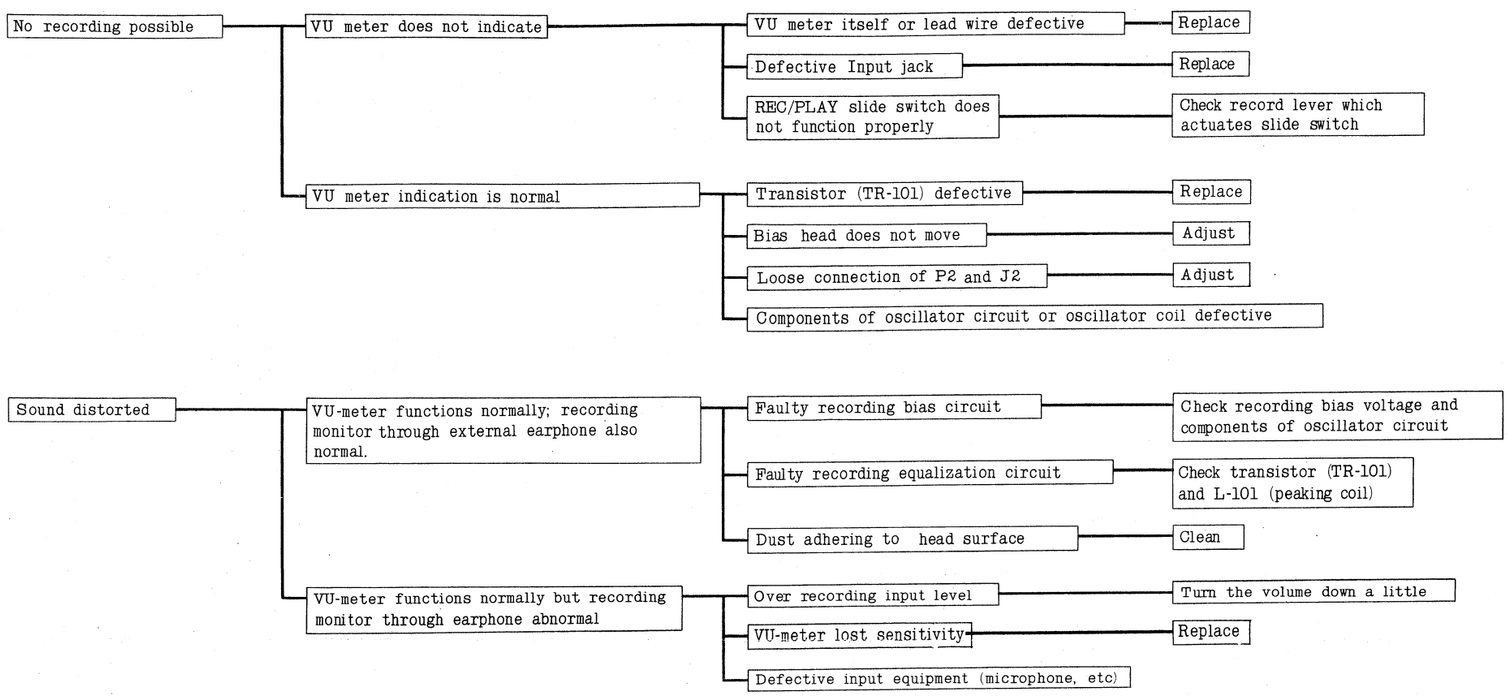


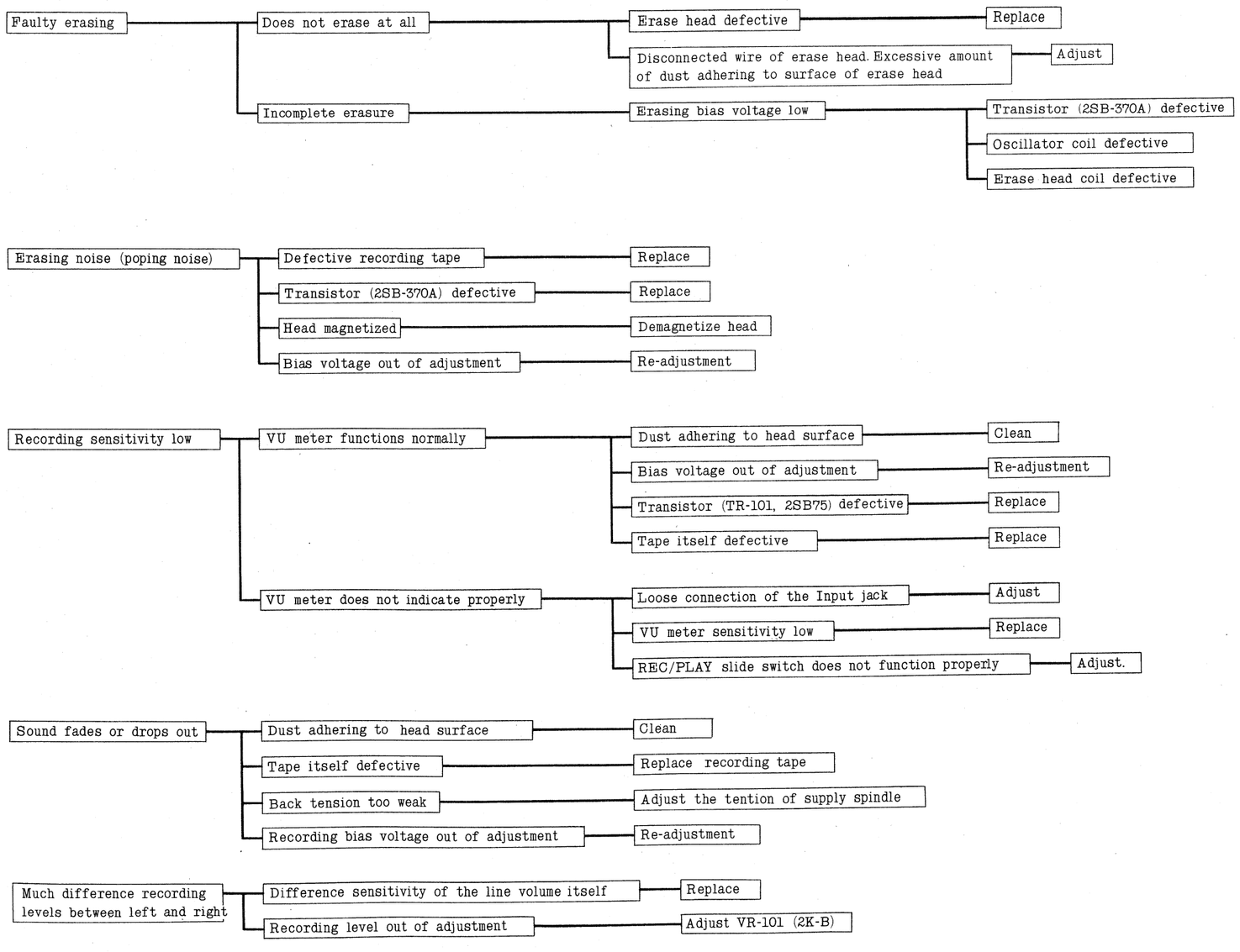




2. Recording problems.

(Unit plays back pre-recorded tapes okay, but recording not satisfactory.)


No recording possible
VU meter does not indicate
VU meter itself or lead wire defective
Replace
Defective Input jack
Replace
REC/PLAY slide switch does not function properly
Check record lever which actuates slide switch
VU meter indication is normal
Transistor (TR-101) defective
Replace
Bias head does not move
Adjust
Loose connection of P2 and J2
Adjust
Components of oscillator circuit or oscillator coil defective
Sound distorted
VU-meter functions normally; recording monitor through external earphone also normal.
Faulty recording bias circuit
Check recording bias voltage and components of oscillator circuit
Faulty recording equalization circuit
Check transistor (TR-101) and L-101 (peaking coil)
Dust adhering to head surface
Clean
VU-meter functions normally but recording monitor through earphone abnormal
Over recording input level
Turn the volume down a little
VU-meter lost sensitivity
Replace
Defective input equipment (microphone, etc)



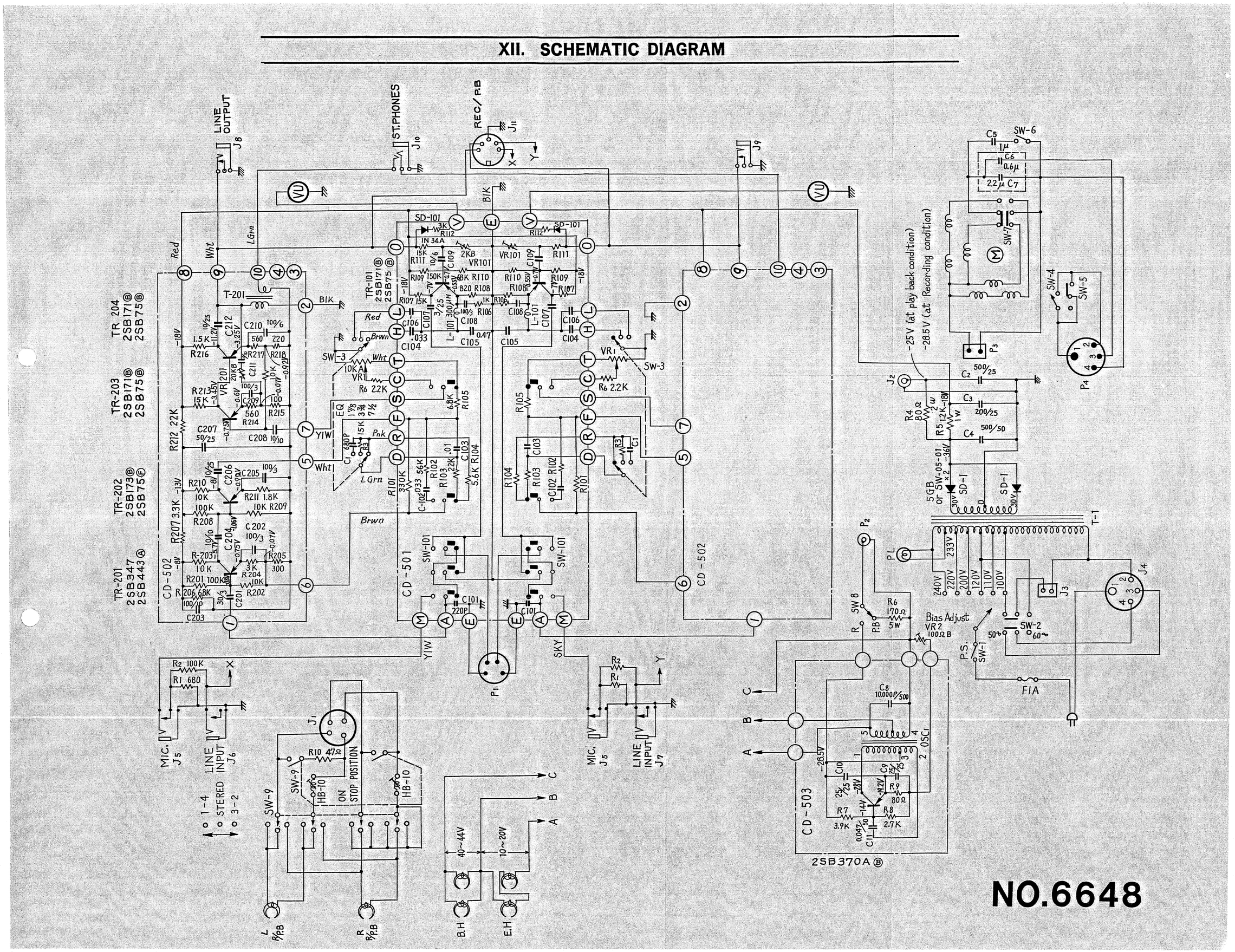
SECTION "B" TROUBLES WITH TAPE TRANSPORT MECHANISM.

- Capstan does not rotate.
  - Troubles with motor.
    - Broken field coil. — Check field coil with tester, and replace motor if coil is broken.
    - Defective motor starting capacitor C7. — Replace C7.
    - Rotor shaft dragging due to lack of oil. — Overhaul motor. Clean and re-lubricate oilite metal.
    - Some foreign matter exists between rotor and stator. — Check and eliminate foreign matter for free rotation of rotor.
  - Troubles with power transmission mechanism.
    - Broken capstan drive belt. — Replace belt.
    - Capstan drive belt off of driving position. — Place belt in position.
    - Motor bushing slipping on motor shaft. — Tighten mounting screw.
    - Oil attached to motor bushing and/or flywheel. — Wipe off oil with cotton swab soaked in alcohol.
- Capstan rotates in Stop position, but tape does not advance when switched to Play position.
  - Troubles with motor.
    - Decreased motor torque. — Check motor torque and replace motor.
    - Defective C7. — Replace C7.
    - Motor bushing slipping on motor shaft. — Tighten mounting screw.
  - Troubles with power transmission mechanism.
    - Capstan drive belt stretched up. — Replace belt.
    - Oil attached to motor bushing and/or flywheel. — Wipe off oil.
    - Capstan bushing silping on flywheel shaft. — Tighten capstan mounting screw.
    - Excessive tension in Takeup/Supply reel table assembly. — Readjust tension.
    - Oil attached to capstan and/or pinch wheel. — Wipe off oil.
    - Insufficient pinch wheel pressure. — Check and re-adjust pinch wheel pressure.
- Capstan advances tape, but take-up reel does not take up tape.
  - Reel shaft dragging due to lack of oil. — Check take-up reel shaft assembly.
  - Take-up idler wheel does not rotate properly. — Check idler wheel. Replace if necessary.
  - Oil attached to idler wheel and roller on take-up reel shaft assembly. — Wipe off oil.
  - Take-up idler wheel does not keep good contact. — Check idler tension spring. Replace spring if necessary.
    - Check lever "G."
- Take-up functions normally, but tape speed lower than regular speed.
  - Troubles with motor.
    - Rotor shaft dragging due to lack of oil. — Overhaul motor. Clean and re-lubricate oilite metal.
    - Defective motor starting capacitor(C30). — Replace C30.
  - Fluctuation in power supply. — Check line voltage and cycle. Use voltage regulator if line voltage is lower than standard.
  - Troubles with power transmission mechanism.
    - Capstan drive belt stretched up and slipping on motor bushing. — Replace belt.
    - Capstan drive belt not in correct driving position. — Place belt in position.
    - Oil attached to motor bushing and/or flywheel. — Wipe off oil.
- Wow · flutter. Irregular tape movement.
  - Troubles with motor.
    - Decreased motor torque. — Check motor torque.
    - Defective moter starting capacitor (C7). — Replace C7.
  - Troubles with power transmission mechanism.
    - Take-up, supply reel shaft dragging or excessive tension. — Check reel shaft assemblies. Replace reel shaft assembly if tension not adjustable.
    - Capstan drive belt stretched up and slipping. — Check belt.
    - Unbalanced flywheel rotation. — Check balance. Replace flywheel.
    - Rubber on pinch wheel deteriorated. — Check rubber on pinch wheel and replace pinch wheel.
    - Pinch wheel or tape guide does not rotate smoothly. — Check and replace defective part. Clean and re-oil if it again provides smooth rotation.
    - Dust on heads. — Clean heads.
    - Insufficient pinch wheel pressure. — Re-adjust pinch wheel pressure.
    - Capstan bushing slipping on flywheel shaft. — Tighten capstan mounting screw.
    - Worn-out idler wheel or no oil. — Replace worn-out idler. Lubricate oilite metal in center of idler.
- Unit does not operate in Fast Forward made.
  - Take-up reel shaft does not rotate even without placing recording tape on unit.
    - Troubles with power transmission mechanism.
      - Oil attached to take-up idler wheel or motor bushing. — Wipe off oil.
      - Loose motor bushing. — Tighten motor bushing mounting screw.
      - Take-up idler wheel does not function properly. — Check and readjust idler wheel.
      - Take-up reel shaft assembly does not function properly. — Check, clean and re-oil reel shaft assembly.
      - Check lever "G".
  - Take-up reel shaft does not rotate when recording tape is placed on unit.
    - Troubles with motor.
      - Decreased motor torque. — Check motor torque. Replace motor if required.
      - Defective motor starting capacitor (C7). — Check and replace C7.
    - Troubles with power transmission mechanism.
      - Excessive slippage of clutch material (felt) in take-up reel shaft assembly. — Check take-up reel shaft assembly.
      - Tape guide roller does not rotate smoothly. — Check guide roller. Re-Oil or replace.
    - Defective reel. — Take-reel warped and sticking to deck top panel. — Check and replace reel.

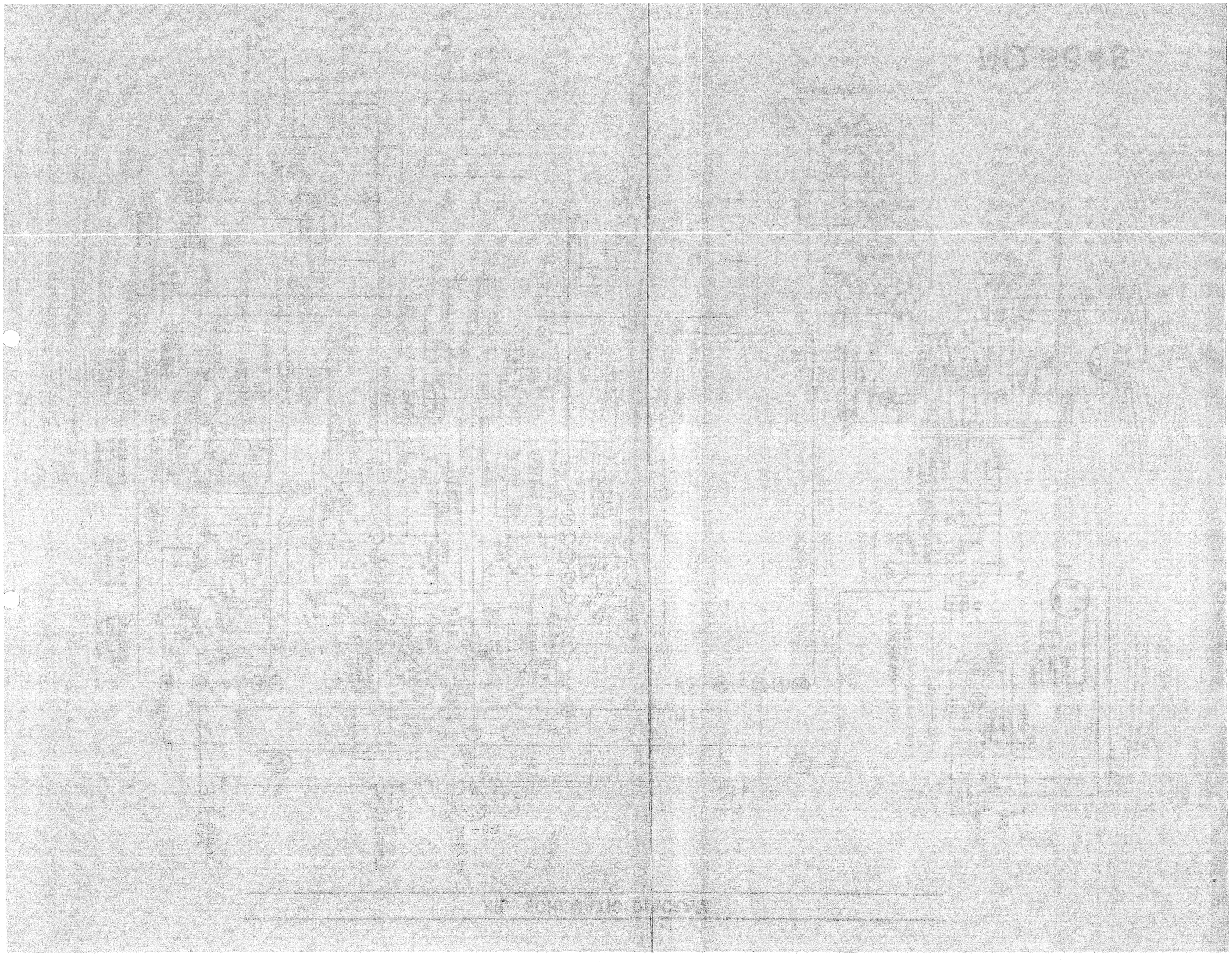
SECTION "B" TROUBLES WITH TAPE TRANSPORT MECHANISM.

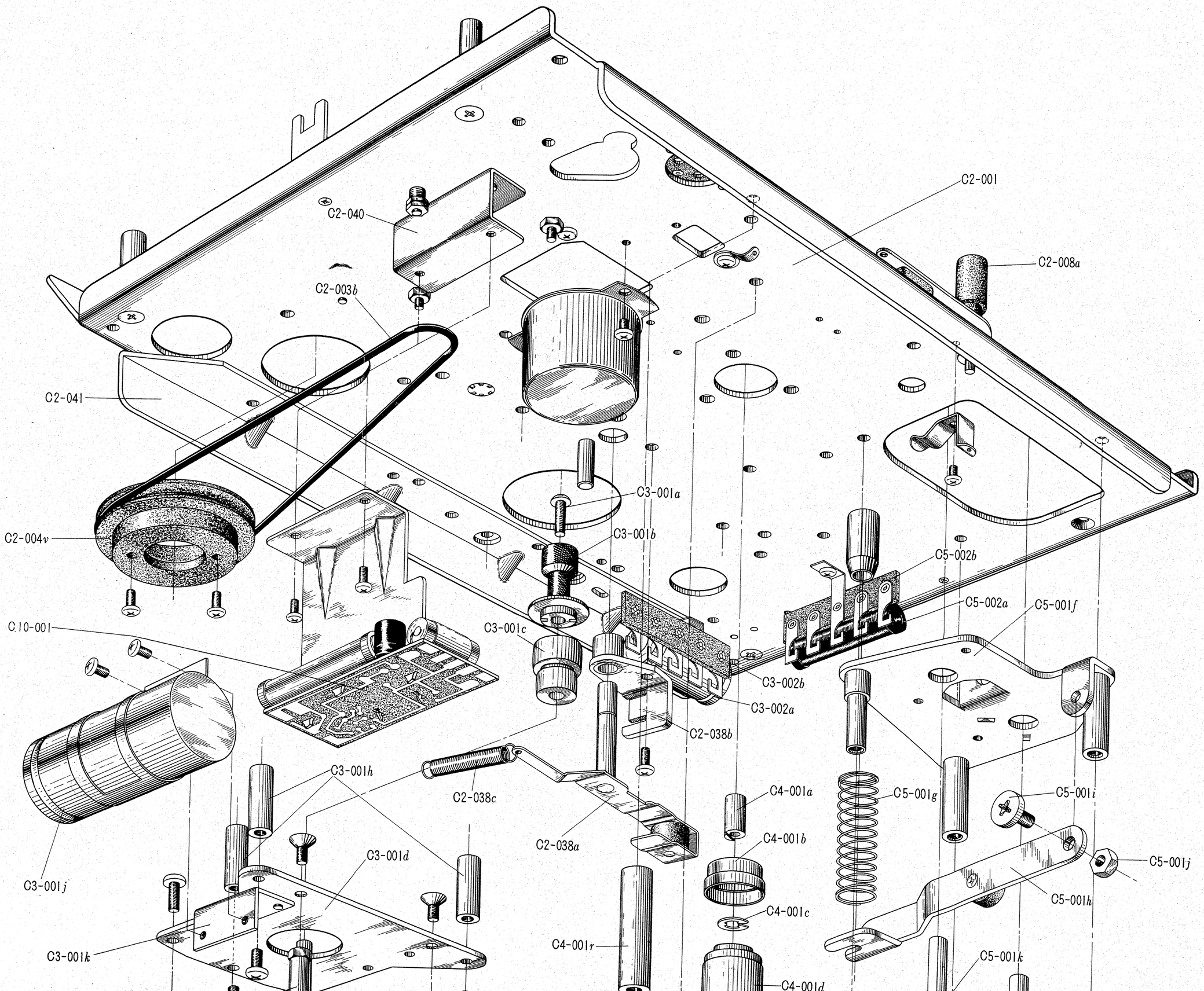
Unit does not rewind tape.	Supply (rewind) reel shaft does not rotate even without placing recording tape on unit.	Troubles with power transmission mechanism.	Oil attached to rewind idler or motor bushing.	Wipe off oil.
			Intermediate idler(black bakelite wheel) not working correctly.	Check internal idler.
			Loose motor bushing.	Tighten motor bushing mounting screw.
			Rewind idler does not rotate or not in position.	Check rewind idler. Clean and re-Oil.
			Supply reel shaft assembly does not rotate smoothly.	Check supply reel shaft assembly. Clean and re-oil.
	Supply (rewind) reel shaft does not rotate when tape is placed on unit.	Troubles with motor.	Decreased motor torque.	Check motor torque. Replace motor if not repairable.
			Defective motor starting capacitor C7.	Replece C7.
		Trouble with power transmission mechanism.	Excessive slippage of clutch material(felt) in supply reel shaft assembly.	Check supply reel shaft assembly.
			Tape guide roller does not rotate.	Check guide roller. Re-oil or replace.
		Defective reel.	Supply (rewind) reel warped and sticking to deck top panel.	Check and replace reel.
Loose tape winding after being placed in Rewind or Fastforward mode.	Decreased back tension of take-up and supply reel shaft assemblies.	Disassemble reel shaft assemblies and strengthen back tension.		
Tape spills when stopped from Rewind or Fast forward mode.	Excessive slippage of felt clutch material in take-up and rewind reel shaft assemblies.	Readjust slippage of felt clutch material. Replace defective reel shaft assembly if this readjustment is difficult.		
	Reels of different size are used. For example, 5" reel on take-up side and 7" reel on supply side.	Always use reels of same size on both sides.		
Break does not function properly.	Worn-out brake shoes.	Check and replace brake shoes.		
	Oil attached to surface of brake shoes.	Wipe off oil with cotton swab soaked in alcohol.		
	Loose brake shoes.	Tighten brake shoes mounting screw.		
	Brake lever does not function properly.	Check and re-adjust brake lever.		
Periodical clack noise when rewinding or fast forwarding tape.	Worn-out and rugged idler wheel.	Check idler wheel.		
Loud motor vibration.	Loose motor mounting screw.	Tighten mounting screw.		
	Defective motor starting capacitor (C7)	Replace C7.		
	Loose oil cover mounting screw.	Tighten mounting screw.		
Squeaking noise when playing tape.	Deposit of dust on heads.	Clean heads.		
	Recording tape is being charged with static electricity.	Replace recording tape.		
	Excessive heat on head surface after continued operation.	Check tape head.		
	Old and worn-out recording tape.	Inspect recording tape.		
	Inferior recording tape.	Use recording tape of good quality.		
Automatic stopping device does not function.	Automatic stop lever moves normally.	Micro switch(SW-4)does not work properly	Check SW-4	
	Automatic stop lever does not move or sticky.	Broken lever spring or lever spring not in position.	Check lever spring.	
		Automatic stop lever sticks to rear deck panel.	Check rear side of deck sub-plate.	
Cycle change switch does not move.	No lubricant on cycle conversion lever.	Relubricate lever.		
	Eccentric or bent cycle conversion lever.	Check cycle conversion lever.		
	Capstan drive belt not on driving track of flywheel.	Check capstan drive belt		
	Loose motor bushing.	Tighten mounting screw.		
	Loose motor mount screw.	Tighten mounting screw.		
	Oil on motor bushing or on flywheel.	Wipe off oil with cotton swab soaked in alchol.		

XII. SCHEMATIC DIAGRAM



NO.6648




C2-001
C2-040
C2-008a
C2-003b
C2-041
C2-004v
C3-001a
C3-001b
C5-002b
C5-002a
C5-001f
C10-001
C3-001c
C3-002b
C3-002a
C2-038b
C3-001h
C2-038c
C4-001a
C5-001g
C5-001i
C4-001b
C5-001j
C2-038a
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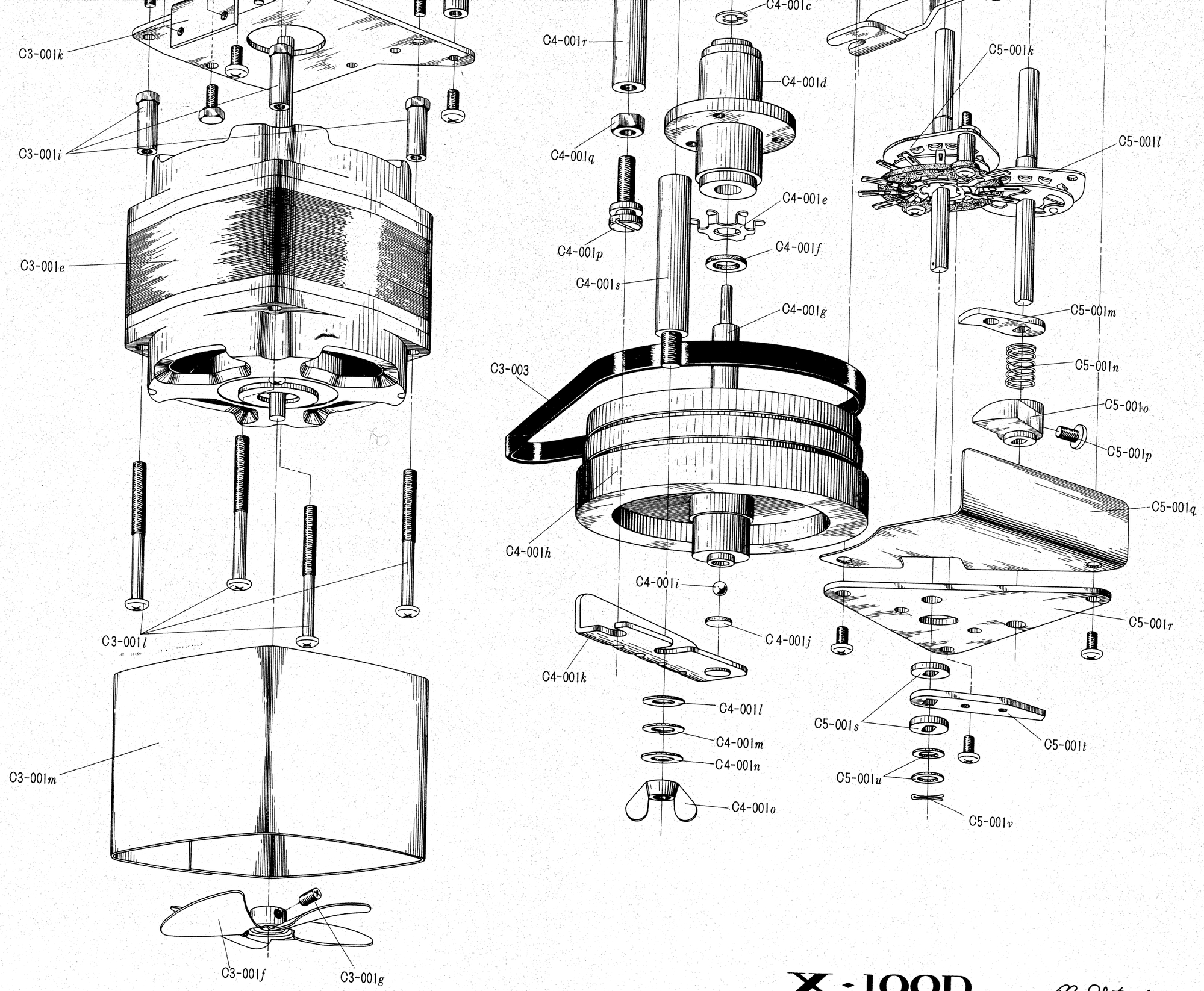
C5-001k
C4-001d



X-100D

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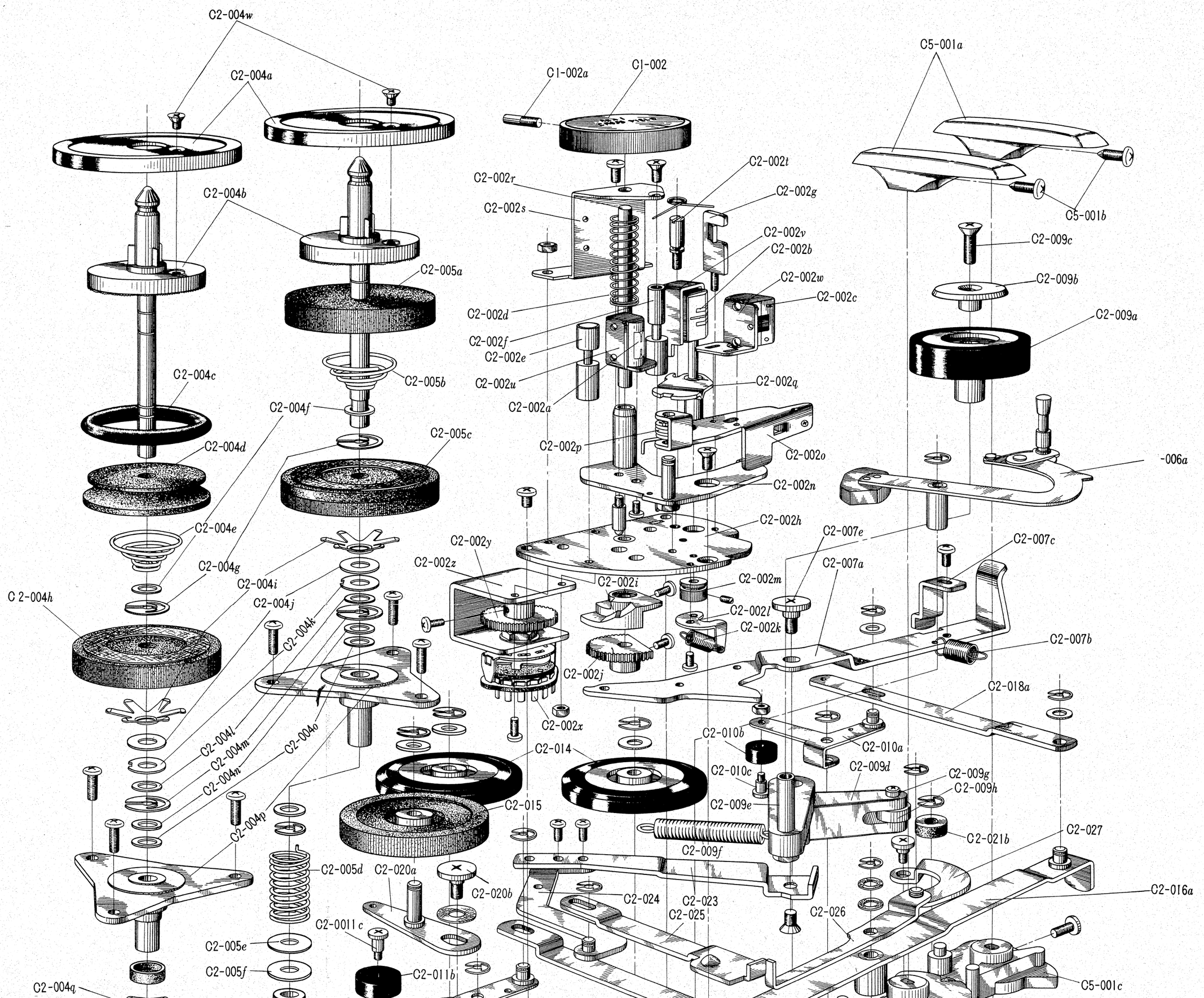
C2-004w
C2-004a
C2-004b
C2-004c
C2-004d
C2-004e
C2-004g
C2-004h
C2-004i
C2-004j
C2-004k
C2-004l
C2-004m
C2-004n
C2-004o
C2-004p
C2-004f
C2-005a
C2-005b
C2-005c
C2-005d
C2-005e
C2-005f
C2-004q
C1-002a
C1-002
C2-002r
C2-002s
C2-002t
C2-002g
C2-002v
C2-002b
C2-002w
C2-002c
C2-002d
C2-002f
C2-002e
C2-002u
C2-002a
C2-002q
C2-002p
C2-002o
C2-002n
C2-002h
C2-002y
C2-002z
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C2-002m
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C2-002k
C2-002j
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C2-020b
C2-0011c
C2-011b
C2-024
C2-023
C2-025
C2-026
C2-009f
C2-009e
C2-010b
C2-010c
C2-009d
C2-009g
C2-009h
C2-021b
C2-027
C2-016a
C2-018a
C2-010a
C2-007e
C2-007a
C2-007c
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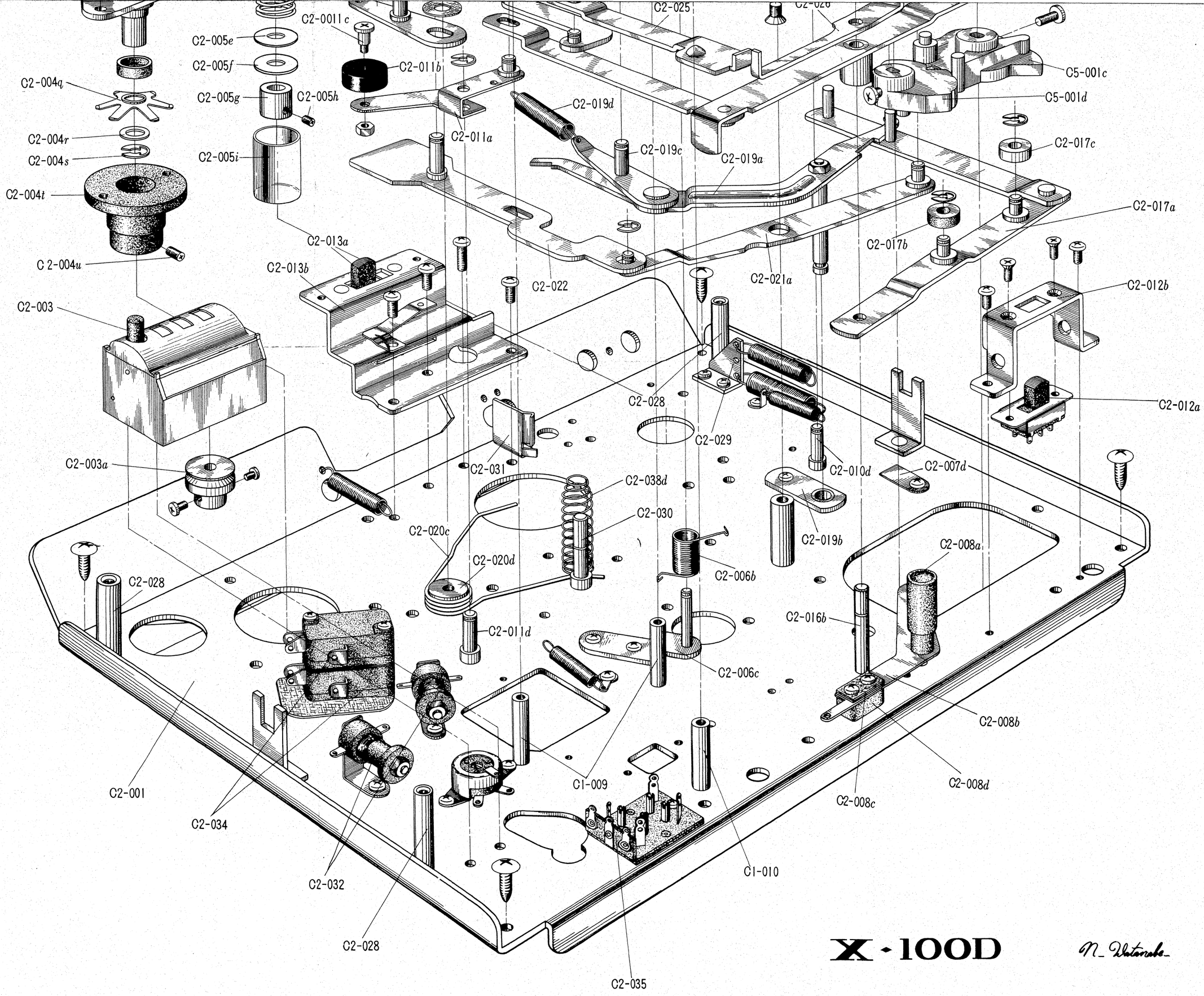
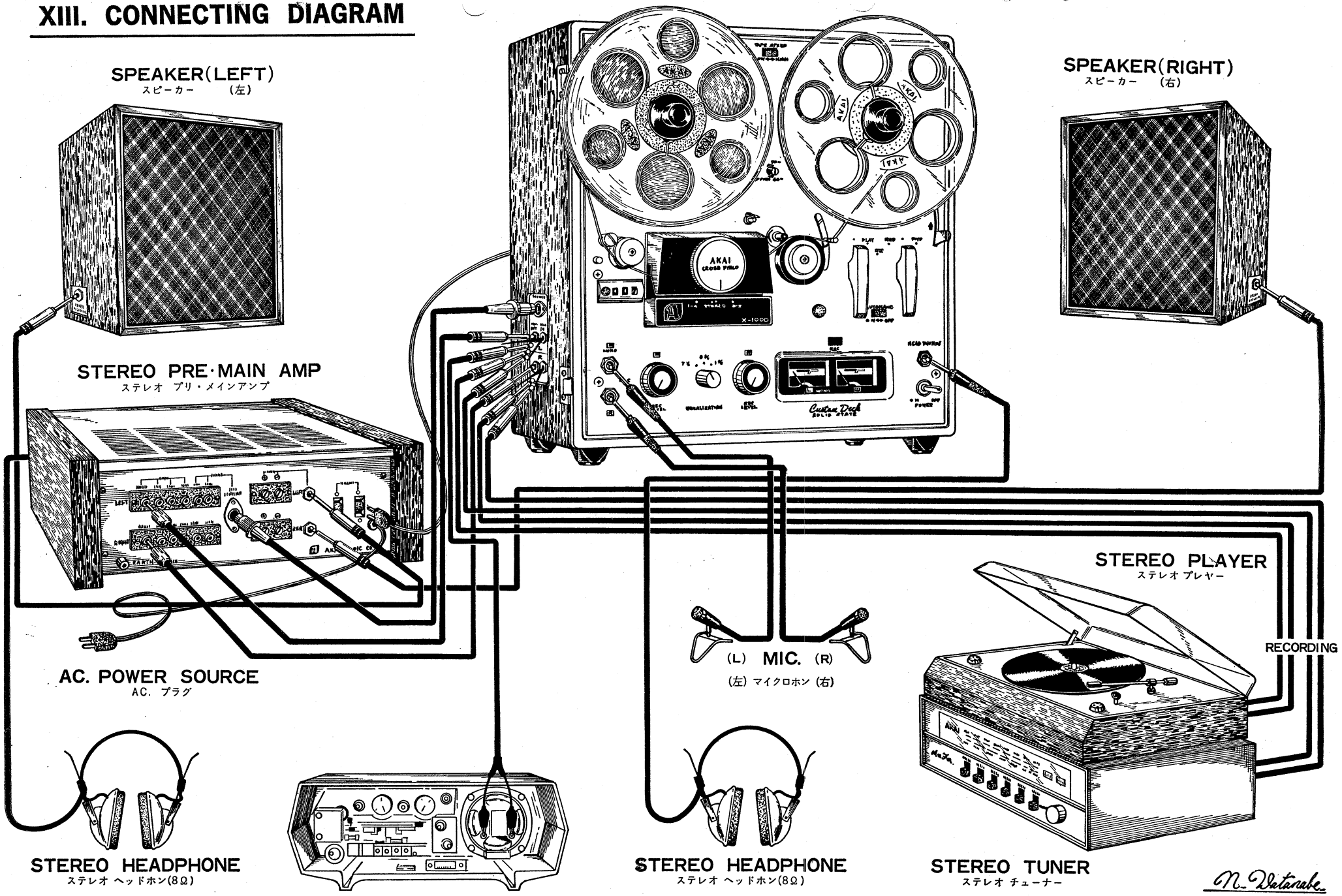
C5-001a
C5-001b
C2-009c
C2-009b
C2-009a
-006a
C5-001c



X-100D

N. Watanabe

XIII. CONNECTING DIAGRAM



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